ASSESSMENT OF THE FISHERY IMPROVEMENT OPPORTUNITIES ON THE PEND OREILLE RIVER

1988 ANNUAL REPORT

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EXECUTIVE SUMMARY

The purpose of this study is to assess the fishery improvement opportunities on the Box Canyon portion of the Pend Oreille River. This three year study was initiated as part of the Northwest Power Planning Council's 1987 Columbia River Basin Fish and Wildlife Program. This report contains the findings of the first year of the study.

Chinook salmon *(Oncorhynchus tshawytscha* [Walbaum]) and steelhead *(Oncorhynchus mykiss* [Richardson]) were present in the Pend Oreille River prior to the construction of Grand Coulee Dam. The river also contained native cutthroat trout *(Oncorhynchus clarki* [Richardson]), bull trout (*Salvelinus confluentus* [Walbaum]) and mountain whitefish *(Prosopium* williamsoni [Girard]). Rainbow trout were planted in the river and some grew to lengths in excess of 30 inches. With the construction of Box Canyon Dam, in 1955, the most productive section of the river was inundated. Following the construction of the dam the trout fishery declined and the populations of spiny ray fish and rough fish increased.

The objectives of the first year of the study were to determine:

1. the relative abundance of each species in the river and sloughs;
2. the population levels in fish in the river and four selected tributaries;
3. fish growth rates;
4. the feeding habits and abundance of preferred prey;
5. the migration patterns; and
6. the total fishing pressure, catch per unit effort, and total harvest by conducting a year-round creel survey.

Electrofishing surveys resulted in the capture of 19,931 fish from March through October, 1988. The catch was composed of 42.1 percent yellow perch, 19.0 percent pumpkinseed, 9.6 percent tench, 7.2 percent largemouth bass, 5.3 percent northern squawfish, 4.8 percent largescale sucker, and 4.3 percent mountain whitefish. Trout were rare with brown trout being the most abundant at 0.6 percent of the total catch.

Population estimates in the 90 km long Box Canyon Reservoir were made using the Schnabel multiple mark and recapture

technique. The yellow perch population was estimated at 41,777,446 with 95 percent confidence limits ranging from 23,872,826 and an upper limit of 80,859,573. The pumpkinseed population was estimated at 16,822,372 with a range of 7,704,903 to 45,879,196. The population estimate for tench was 4,282,807 with a range of 2,081,920 to 10,707,019. The estimated population for largescale suckers was 821,863 with the 95 percent confidence limits at 432,560 to 1,849,192. The longnose sucker estimate was 781,166 with a range of 357,786 to 2,130,452. The population estimate for largemouth bass was 657,549 with a range of 455,727 to 989,859. The squawfish population estimate was 580,565 with the 95 percent confidence limits at 357,271 and 1,009,679. The black crappie population estimate was 579,588 with a range of 103,498 to 5,795,881. The population estimate for mountain whitefish was 164,252 with a range of 120,185 to 231,258. Trout populations could not be estimated due to their low rate of capture.

Population estimates were made for five tributaries using either the Petersen or removal depletion method. Skookum Creek populations (±95% C.I.) were estimated to be 10,543±4,551 brown trout, 13,625±5,369 brook trout, and 47±23 cutthroat trout for the entire 17.1 km length of stream. Population estimates for Cee Cee Ah Creek were 11,357±3,411 brown trout, 9,11 1±2,564 brook trout, and 42±28 cutthroat trout in 15.5 km. Populations estimates for Tacoma Creek were 90,903±75,655 brook trout and 4,072±7,059 cutthroat trout in 33.1 km. Population estimates for the West Branch of LeClerc Creek were 1,222±216 brown trout, 1,043±72 brook trout, and 72 cutthroat trout in 26.3 km. The population estimates for Ruby Creek were 25,568±6,486 brook trout and 1,598 cutthroat trout in 18.8 km.

Growth rates for largemouth bass, yellow perch, brown trout, brook trout, and rainbow trout in the reservoir were low in comparison to other locations. Growth rates for mountain whitefish, black crappie, and cutthroat trout were as good or better than those from other locations. Growth rates of trout in Pend Oreille River tributaries tended to be lower than other locations in the Pacific Northwest for brown trout but higher for brook trout and cutthroat trout.

Even though their growth rates were lower than normal, a substantial number of largemouth bass in excess of 500 mm and some brown trout over 600 mm were captured. One rainbow trout was captured that was 720 mm long. Largemouth bass concentrate in the sloughs in the late spring to spawn and during this time bass over 500 mm were not uncommon in electrofishing surveys. In the late summer and fail a fair number of brown trout greater than 600 mm and mountain whitefish over 400 mm were captured in Cee Cee Ah Slough, at the mouth of Cee Cee Ah Creek. Therefor, some species do attain large sizes in the reservoir, however they are typically only captured during times when they are concentrated.

Mean annual invertebrate densities in the river ranged from 4,508 to 17,234 organisms/m* at reservoir sites. Mean annual densities in the sloughs ranged from 6,415 to 13,354 organisms/m*. Densities in the river and sloughs were also lower than other locations but diversities were higher. Mean annual invertebrate densities in Pend Oreille River tributaries ranged from 4,823 organisms/m* in LeClerc Creek to 5,921 organisms/m* in Cee Cee Ah Creek. Mean annual densities in the drift ranged from 68 organisms/l 00 m^3 in Cee Cee Ah Creek to 282 organisms/l00 m^3 in Skookum Creek. Invertebrate densities were also lower in the tributaries than in other streams of comparable size in the region but the diversities were higher.

Mean tooplankton densities ranged from 45 organisms/l in October to 326 organisms/l in June. For the year, 58 percent of the zooplankton were rotifers, 32 percent were copepods, and 10 percent were cladocerans. Cladoceran biomass ranged from 5.8 . micrograms/l April to 20.7 micrograms/l in June. Cladoceran and copepod densities were higher than most other lakes and reservoirs in the region.

Diet analysis of river and slough fish revealed that yellow perch, black crappie, tench, and 0+ through 3+ largemouth bass were primarily planktivorous. All other species fed on benthic macroinvertebrates most frequently except cutthroat trout and redside shiners, which fed upon terrestrial organisms, and older largemouth bass and northern squawfish, which fed upon fish. All species of fish were opportunistic in their feeding with most electivities near zero. Diet overlaps were high between yellow perch and young bass due to their common reliance upon zooplankton as a food item. Overlaps were also high between young bass and black crappie, black crappie and yellow perch, pumpkinseed and mountain whitefish, pumpkinseed and brown bullhead, and mountain whitefish and brown bullhead.

The feeding analysis of tributary trout revealed that, based on the Index of Relative Importance, Baetidae and Limnephillidae were important brown trout food organisms. Trichoptera pupae, Limnephillidae, Oligochaeta, and Chironomidae pupae were important food items for brook trout and Diptera adults, Elmidae, and Hymenoptera were important to cutthroat trout. Electivities indicated that all tributary trout were relatively opportunistic with most values around zero.

From March through December angler effort was estimated at 4,139±467 hours. The CPUE was estimated to be 2.06 fish/hour for boat anglers and 2.90 fish/hour for shore anglers. Largemouth bass made up 68 percent of the catch by boat anglers followed by yellow perch at 21 percent. Yellow perch made up 66 percent of the catch by shore anglers followed by brown bullhead and pumpkinseed at 10 and 9 percent, respectively. The CPUE for harvested fish was 0.34 fish/hour by boat anglers and 0.93 fish/hour for shore anglers. The total harvest was estimated at 2505±312 fish including 1,268±157 yellow perch, 389±40 largemouth bass, 312±44 brown bullhead, and 278±39 pumpkinseed. The differences in the CPUE's can be largely attributed to the catch and release fishing of bass anglers and the small size of most of the yellow perch in the river. The success of bass anglers during the catch and release bass tournaments was not included in the calculation CPUE.

One question that was not answered during the first year of data collection was where do the large brown trout, mountain whitefish, and largemouth bass go during the time they are not in the sloughs and tributary mouths? This question will, hopefully, be addressed in future years by sonic or radiotracking. Another question that needs attention in future years is how much do the tributaries contribute to the reservoir fishery?

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1 .O INTRODUCION

In 1987, the Northwest Power Planning Council amended its Columbia River Basin Fish and Wildlife Program to include: "An *assessment of fishery improvement opportunities in the Pend Oreille River within the boundaries of the Kalispel Indian Reservation. This survey will provide: i) Baseline information about existing fish populations and habitat and ii) information on possible means of improving fisheries. When the assessments are completed, recommendations for projects will be submitted to the Council"* [Section 903(g)(l)(G)]. The Council's Five Year Action Plan stated that the Bonneville Power Administration (BPA) should commence funding of a three year assessment of the fishery improvement opportunities on the Pend Oreille River adjacent to the Kalispel Reservation starting in Fiscal Year 1988 [Section 1400(7.7)]. In 1988, BPA contracted the Kalispel Tribe to conduct this assessment. This report contains the results of the first year of the survey.

1.1 FISHERIES MANAGEMENT HISTORY OF THE PEND OREILLE RIVER

Historically, both chinook salmon *(Oncorhynchus tshawytscha* [Walbaum]) and steelhead *(Oncorhynchus mykiss* [Richardson]) formerly spawned in the Pend Oreille River (Gilbert and Evermann 1894; Bryant and Parkhurst 1950; Fulton 1968, 1970; and Fulton and Laird, unpublished report). Gilbert and Evermann (1894) .reported that *"steelhead were abundant in the Pend Oreille River in 1894."* Salmon and steelhead continued to be present in the lower segment of the river until Grand Coulee Dam was built (Bryant and Parkhurst 1950).

A report by McDonald (1894) to the United States Senate contained a map entitled *"The natural limits of the distribution of salmon in* the Columbia Basin" , which showed salmon as being present in the Pend Oreille System. McDonald's map was based upon information obtained by Livingston Stone (1885) who was sent by the U.S. Fish Commission to survey the Clark Fork and Pend Oreille Rivers for the purpose of selecting a hatchery site at a point along the Northern Pacific Railway Line. Stone reported, "Very few salmon *reach Lake Pend Oreille or the Clark Fork above the Lake. The testimony of all persons consulted on the subject at Deer Lodge, Missoula, Sandpoint and* at *various smaller stations on the railroad was unanimous to the effect that no salmon were ever caught in*

Clark Fork or above. The cause of the absence of salmon on Lake Pend Oreille or above is the fails of Senniacwateen [i.e., Albeni Falls] *75 miles below the outlet of the Lake. "*

In an article published in *Transactions of the American Fisheries Society* in 1883, Stone wrote, "I heard *of salmon being caught all the way up to the falls of the Senniacwateen [i.e., Albeni Falls]--so the salmon are obviously not all stopped at the falls of the Pend Oreille [i.e.,* Metaline Falls], *though probably nof a very large proportion get by them. The falls of the Senniacwateen . . . mark the highest point of the upward migration of salmon on* [the Pend Oreille River]."

Gilbert and Evermann **(1894)** were the only investigators to explore the entire length of the Pend Oreille River. They described Albeni Falls, Box Canyon, **and** Metaline Falls as the most serious obstacles to salmon. On Page 181, Gilbert and Evermann (1894) note that while Metaline Falls was the most formidable obstacle on the Pend Oreille River, it was known to be easily passable and did not interfere with the ascent of salmon.

Native resident fish in the Box Canyon reach included cutthroat trout *(Oncorhynchus clarki* [Richardson]) and bull trout *(Salvelinus confluentus* [Walbaum]). Gilbert and Evermann (1894) reported, [bull trout] *are abundant in the Pend Oreille River. We saw in the possession of* **art Indian several fine specimens, the largest of** *which was 26 inches long, 11 inches in greatest circumference, and weighed 5 pounds and 1 ounce."*

The Kalispel Tribe historically depended heavily on fish for subsistence and used a variety of means to catch both anadromous salmonids and resident fishes such as char, trout, chub, whitefish, suckers, and squawfish (Bonga 1978). Ray (1937) reported that the Kalispels maintained a permanent village at the mouth of the Calispel River near Cusick, WA. During the early summer up to one thousand persons often gathered for the communal distribution of fish caught in the fish trap maintained at the site (Ray 1937).

While the construction of Grand Coulee Dam eliminated salmon and steelhead from the Pend Oreille River, the construction of Box Canyon Dam in 1955 resulted in a decline in the population of resident salmonids. Evidence to support this contention can be found in correspondence and creel information on file at the Washington

Department of Wildlife (WDW, formerly Washington Department of Game [WDG]) Regional office in Spokane WA.

In a letter dated May 15, 1949 from Don Earnest (WDG, Spokane) to Clarence Patuzke (WDG, Seattle) was the following information on the Pend Oreille River: *"Rainbow in large numbers are being caught in the Pend Oreille River from fingerlings planted in 1946 and 1947. Most of these fish are now 17 to 18 inches in* length. Many **large** *fish* are *being* taken. *One* **rainbow** *had a dressed weight of 13 Ibs 9 oz, length of 3 1 inches and girth of 20 inches. Such stream survivals have not been found elsewhere."*

In a letter dated October 1, 1952 from Don **Earnest (WDG,** Spokane) to Robert C. Meigs (WDG, Seattle) concern was expressed about the potential impacts of Box Canyon Dam. *"From the damsite upstream for approximately 25 miles is found the majority of the riffle and fishable pool area of the entire Pend Oreille River. The elevation at Box Canyon is 1195 ft at low water (1943) and at Ruby 2023.5* **-- a difference** *of 28.5 ft. The pool* **elevation of 2025** *will inundate all the good riffle and pool area in the 25 miles of Box Canyon. Fish populations of the Pend Oreille River are relatively heavy. Good populations of large rainbow, cutthroat and brown trout inhabit the riffle and pool areas principally. Whitefish are found in countless thousands throughout all riffle and pool areas . . . When Box Canyon Dam is built at least 75% of the best water in the Pend Oreille River will be destroyed as trout and whitefish habitat. The results of such impoundments are well illustrated in Roosevelt Lake. Prior to construction of Coulee Dam whitefish were very abundant. They* **are still below Coulee but on/y small** *remnants are found in Lake Roosevelt. Rainbow trout were found in all the faster water. At present the rainbow and cutthroat are restricted to the extreme upper portion of Roosevelt Lake where the river is still in relatively natural condition and good fishing is enjoyed only in this area."*

A newspaper article in the April 3 issue of the Metaline Falls Gazette reported that a 15 lb 8 oz rainbow **was** caught in Pend Oreille during a 1957 Field and Stream tournament. Also caught in the tournament were a 13 lb 9 oz rainbow, 9 lb 8 oz rainbow, 6 lb 8 oz rainbow, and many large Dolly Varden [i.e., bull trout].

In 1958, Don Earnest (WDG, Spokane) stated that the river was **"a** *lost cause* **for trout and** *will be full of squawfish in* **a few years."** In August, 1968 a squawfish derby was held and during an 18 day period 3,350 squawfish and 27 game fish were caught.

In a letter dated July 17, 1972 to the United States Department of Interior (Portland), L.G. Perry (USFWS Bureau of Sport Fish and Wildlife) made the following statement concerning the Box Canyon Reservoir: *"Formerly* as *the free-flowing Pend Oreille River, it provided a salmon fishery of moderate to high value. Presently the reservoir supports primarily a spiny ray fishery that is largely unused. "*

In a letter dated April 19, 1973 to Mr. Bob Bayless, R. R. Simmons (WDG) remarked that *"Good fishing on the Pend Oreille River cannot be expected."*

A letter dated May 9, 1978 from Ray Duff (WDG, Spokane) to Dave Gufler (WDG, Olympia) contained the following: *'Box Canyon Dam* was *completed in 1955. Prior to impoundment, the free-flowing Pend Oreille River offered some fair trout angling, which according to our records, diminished shortly after completion of the dam. Most recently, the bass fishery* has *received considerable interest (from Spokane Bass Clubs). A primary concern to many has been the water fluctuations during June, which is the peak spawning period for the Pend Oreille River bass population. Shallow flooded areas are essential for reproduction. Stable water levels would be helpful. To my knowledge, no efforts were made by the department to mitigate lost resources as a result of Box Canyon Dam construction. I believe Box Canyon Dam was built by the Pend Oreille County PUD and Albeni Falls by U.S. Army Corps of Engineers. I further believe that neither impoundment has been used for flood control, only power generation. "*

Creel census data collected by the WDW from 1946 to 1985 demonstrates the decline in the trout fishery in the Pend Oreille River. Prior to 1958, the river was primarily a cold water fishery with cutthroat trout, rainbow trout *(Oncorhynchus mykiss* [Richardson]), brown trout *(Salmo trutta* [Linnaeus]), and whitefish making up most of the creel. The dam construction resulted in the river being converted from a free flowing system to slow moving reservoir. The flooding resulted in the formation of shallow sloughs that provide spawning areas for warm water species such as largemouth bass, pumpkinseeds, and black crappie. The proliferation of aquatic macrophytes provided yellow perch with ample spawning habitat and cover from predators and led to increased numbers of herbivorous *(i.e.,* tench) and detritivorous fishes (i.e., suckers). The substrate in the reservoir is dominated by mud and silt with a few areas having sand, gravel, or cobble. The physical changes in the habitat, resulting from dam construction, has led to a change in the creel to warm water species since 1958 (WDW files).

Trout species are now more abundant in tributaries than in the reservoir. The WDW, in 1978, set gill nets in Sand and Sweet Creeks, catching brown trout to 21 inches, rainbow trout in the 6 to 7 inch range, cutthroat trout to 12.5 inches, and whitefish 8 to 14 inches long. Anderson et al. (1985) conducted a population estimate for Cee Cee Ah Creek, on the Kalispel Indian Reservation. The population estimate (+ 95 percent confidence interval) for a 700 yard section from the mouth upstream was 1417 f 213 brown trout, 123 + 36 brook trout, and 1578 + 851 sculpins.

1.2 STUDY OBJECTIVES

The purpose of this three year study is to identify fishery improvement opportunities for the Box Canyon Reservoir of the Pend Oreille River. Species that will be targeted in this study include all trout, mountain whitefish (Prosopium williamsoni [Girard]), largemouth bass *(Micropterus salmoides* [Lacepede]), black crappie *(Pomoxis nigromaculatus* [Lesueur]), and yellow perch (Perca *flavescens* [Mitchill]). The objectives of the study are to collect information on:

1. population dynamics (including relative abundance, population levels, natural and fishing mortality, and recruitment;
2. growth rates;
3. feeding habits;
4. behavior patterns; and
5. factors limiting fish production (e.g., food availability, competition, habitat availability, environmental fluctuations).

At the end of the study, the information will be combined to develop recommendations for fisheries projects, cost estimates for each alternative, and estimates for success (in terms of increasing fish production) of each alternative. The three year time period should provide enough time so that any changes in fish populations, fish growth, and fish diets due to environmental fluctuations could be observed and analyzed. Upon completion of these assessments, recommendations for fisheries enhancement projects will be submitted to the Northwest Power Planning Council.

The first year study objectives were to determine:

1. the relative abundance of each species in the river and sloughs;
2. the population levels in four selected tributaries and, if possible, for fish in the river and sloughs;
3. fish growth rates;
4. the feeding habits and abundance of preferred prey;
5. the migration patterns; and
6. the total fishing pressure, catch per unit effort, and total harvest by conducting a year-round creel survey.

Also during the first year, information was collected on fish habitat utilization. This information will be combined with data collected in the following years for the construction of habitat utilization and preference suitability indices.

2.0 METHODS AND MATERIALS

2.1 DESCRIPTION OF THE STUDY AREA

The Pend Oreille River begins at the outlet from Pend Oreille Lake, ID, and flows in a westerly direction. The river turns north near Dalkena, WA, and flows into British Columbia, Canada, where it enters the Columbia river. The approximate drainage area of the river at the international border in 65,300 km*. Fig. 2.1 shows the 35 year mean monthly flows and the mean flows that occurred in 1988 at Newport WA. The normal high flow month is June with a mean discharge of 62,991 CFS. In 1988, the mean flow in June was only 22,127 CFS and the high flow was April with a mean discharge of 25,890 CFS. The normal low flow month is August with a mean discharge 12,069 CFS. In 1988, the lowest mean monthly flow was also in August with a mean discharge of 5,875 CFS. Thus, in the first year of the study, abnormally low flows were encountered.

The study area covers the 90 kilometer section of the river from Box Canyon Dam at river kilometer (RK) 55.5 to Albeni Falls Dam at RK 145 (Fig. 2.2). Within this reach eleven river, four slough, and four tributary study sites were established (Table 2.1). The tributaries studied were Skookum Creek, Cee Cee Ah Creek, Tacoma Creek, and LeClerc Creek. A population estimate was also conducted on Ruby Creek.

Fish species known to occur in the Box Canyon Reservoir of the Pend Oreille River includes: brown trout, cutthroat trout, rainbow trout, brook trout *(Salvelinus fontinalis* [Mitchill]), bull trout, mountain whitefish, largemouth bass, black crappie, pumpkinseed *(Lepomis gibbosus* [Linnaeus]), yellow perch, tench *(Tinca tinca* [Linnaeus]), redside shiner (Richardsonius balteatus [Richardson]), northern squawfish (Ptychocheilus oregonensis [Richardson]), peamouth (Mylocheilus caurinus [Richardson]), lake chub *(Couesius plumbeus* [Agassiz]), long nose sucker *(Ca tos tomus ca tostomus* [Forster]), largescale sucker *(Catostomus macrocheilus* [Girard]), brown bullhead *(lctalurus nebulosus* [Lesueur]), and sculpin *(Cottus* spp.). One kokanee *(Oncorhynchus nerka* [Walbaum]) was captured during electrofishing in 1987. This fish presumably originated from Pend Oreille Lake. Sturgeon *(Acipenser transmontanus* [Richardson]) have been reported in the river, however, we were unable to catch any by setting 19, 18 gangion sturgeon set lines for 243 hours during May, June, and July, 1988. A total of 753,000 walleye *(Stizostedion*

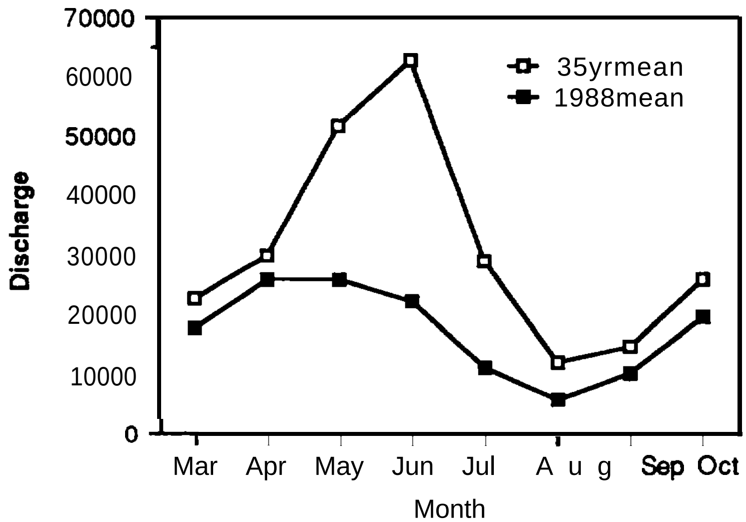

Fig. 2.1. **Comparision of 35 year (19534987) mean monthly flows with the mean monthly flow during March through October 1988 at Newport, WA (USGS gage 12395500). The 19534987 data was compiled from USGS reports by Soltero et al. (1988) and the 1988 provisional data was obtained from the USGS, Sandpoint, ID.**

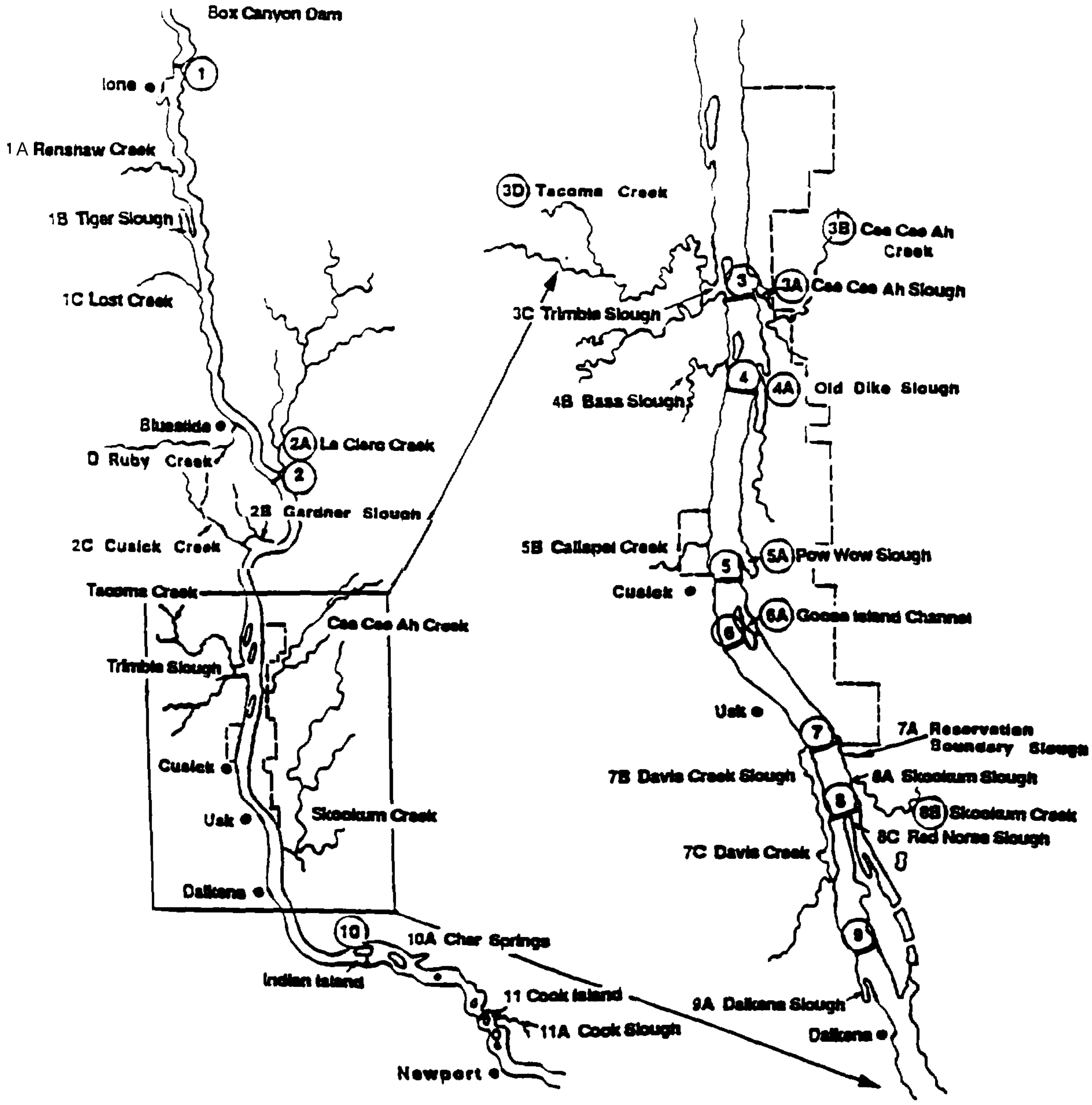

Figure 2.2. Map of the Pend Oreille River showing the location of study sites.

Table 2.1. Locations of study sites. Sites shown on Fig. 2.1 but not described here are not normal study sites but will be sampled when time and budget allows.

STUDY SITE	LOCATION
1	At **RK 59.5,** just north of lone, **WA**
2	At RK 90.4, near the confluence with LeClerc Creek
2A	LeClerc Creek; confluence with the Pend Oreille river at RK 90.4
3	At about RK 107, near the mouth of Cee Cee Ah Slough
3A	Cee Cee Ah Slough; located at RK 107 on east bank
3B	Cee Cee Ah Creek; enters Cee Cee Ah Slough
3D	Tacoma Creek; enters Trimble Slough located on west bank at RK 107
4	At RK 108.6
4A	Dike Slough; east bank at RK 108.6
5	At RK 113, adjacent to Cusick, WA
5A	Pow Wow Slough; east bank at RK 112
6	At RK 114, adjacent to Goose Island
6A	Goose Island Slough, at RK 114
7	At RK 116.5
8	At RK 119, near mouth of Skookum Creek
8B	Skookum Creek; enters river on east bank at RK 118
9	At RK 121.5
10	At RK 130, adjacent to Indian Island
11	At RK 139.2, adjacent to Cook Island

vitreum vitreum [Mitchill]) fry were planted in the reservoir in 1983 and 1984 and 148 adult tagged walleye were planted in 1987. No confirmed citing of walleye has been made. However, several anglers have reported catching walleye.

2.2 SAMPLING REGIME

All the information contained in this report was collected from March through October, 1988, with the exception of the creel which includes data collected through December.

Between 4 to 10 days were spent in the field each month. Fish in the river and sloughs were marked for estimating population size monthly while collecting relative abundance, age, growth, and condition information. Tributary populations were measured during 5 days in May. Information on fish feeding habits and food availability in the river, sloughs, and tributaries was collected in April, June, July, September, and October. Habitat utilization measurements were made in June and July. Creel data was collected on 18 days (12 weekday and 6 weekend days) each month.

2.3 RELATIVE ABUNDANCE

Fish relative abundance was determined by electrofishing using a Smith-Root SR-18 boom electrofishing boat with the voltage adjusted to produce a current of about 8 amps. River stations were sampled monthly from March through October, and sloughs were sampled when accessible. During some months some sloughs were not accessible due to heavy macrophyte growth, low water levels, or both. Generally a minimum three ten-minute electrofishing transects were made at each study site. This included one along each bank, or along weed beds, and one across the river.

Additional relative abundance information was collected using gill nets following the methods of Hubert (1983). Monofilament research nets were set at various depths in the river to sample the entire water column. Typically, the nets used at study sites 2 through 11 were 6, 8, 10, or, on occasion, 20 feet deep and 200 feet long with 4 graded panels of various square mesh sizes ranging from 0.5 to 4 inches. On occasion, at study site 1, a 50 foot deep x 150 foot long net with 3 graded panels was used. Two nets were usually set at a study site perpendicular or parallel to the shore. During some months nets were not set at all study sites to allow nets to set longer in one location.

A 6.8 X 1 .I meter bag seine was used to collect young-of-the-year fish from July through October in the sloughs. Seine hauls were made parallel to the shore. A fiberglass tape was stretched along the shore to measure the distance of each haul. Generally, three 30.5 meter hauls were made at study sites 4A, 5A, 8C, and 9A each month.

During electrofishing, selective netting was sometimes used to catch target species found in low numbers in the relative abundance samples. By targeting these species in areas where they were more common, it was possible to collect more information on them. These fish were not included in the relative abundance data.

Fish collected by electrofishing, gill nets, and beach seining were identified to species, measured to the nearest millimeter, and given a site specific tag. Larger fish were given a Floy FD-68B numbered anchor tag and smaller fish, and non-target species were given a Floy FD-67F anchor tag with the paddle removed. Tag types and colors used at each study site can be found in Appendix A. Fish considered too small to tag were not marked. Scales were removed and a weight taken from a representative group of each target species for age and growth determination.

2.4 POPULATION ESTIMATES

2.4.1 TRIBUTARIES

Brown trout, rainbow trout and cutthroat trout populations were estimated in four tributary streams in May, 1988. The Petersen Method was used to estimate the trout populations and evaluate the accuracy of the estimate (Ricker 1975, Lackey and Hubert 1978, Everhart and Youngs 1981) in Skookum, Cee Cee Ah, and Tacoma Creeks. The removal-depletion method (Zippin 1958) was used on LeClerc Creek due to the low capture rate in that stream.

Four 200 yard sections were randomly selected to represent the longitudinal variation in habitat of each tributary (Figs. 2.3 through 2.6). Each section was electrofished using the standard guidelines and procedures described by Novotany and Priegel (1971, 1973) and Reynolds (1983). Fish were collected by spot shocking using a Smith-Root Type VII pulsed-DC backpack electrofisher.

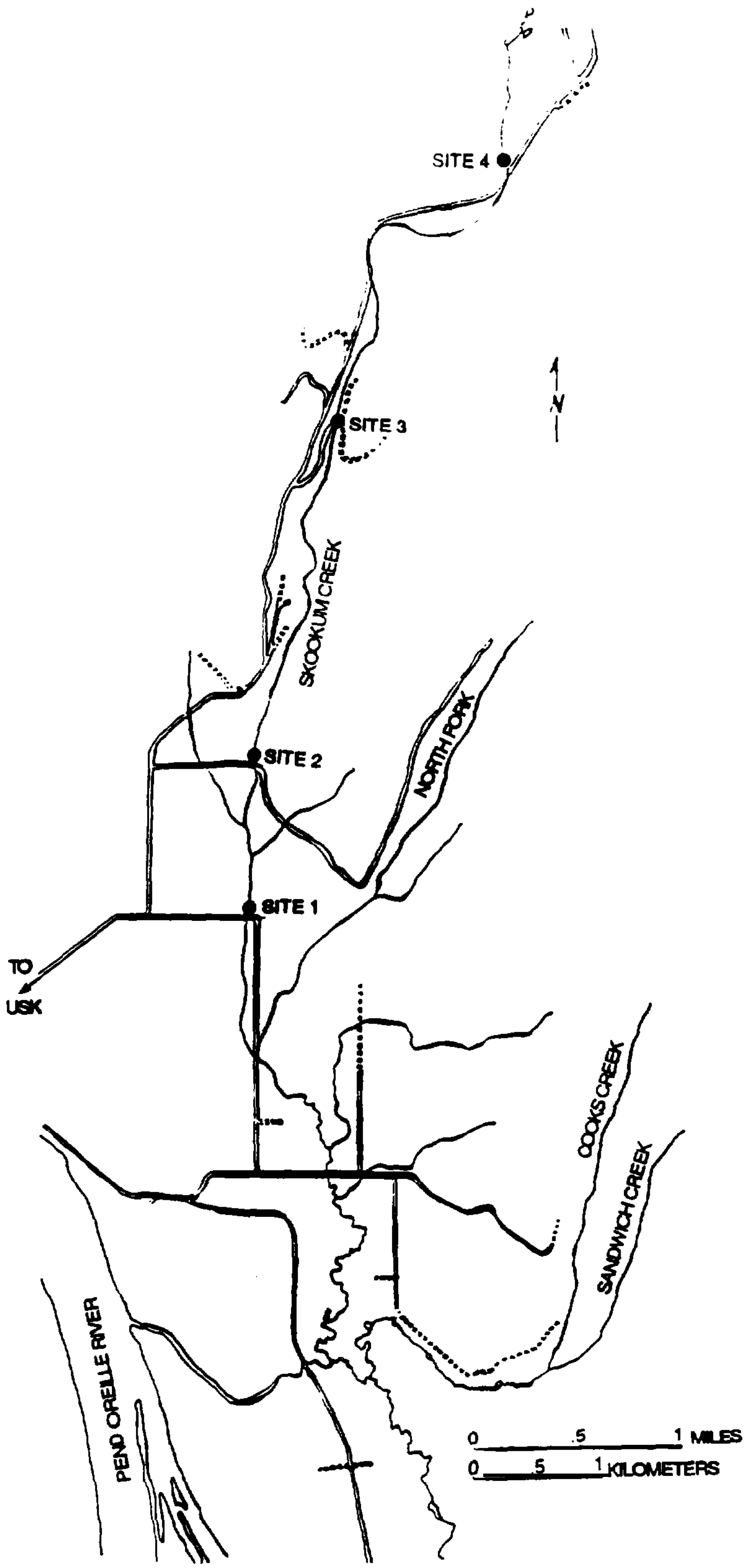

Figure 2.3 Map of Skookum Creek showing the locations of the population study sites.

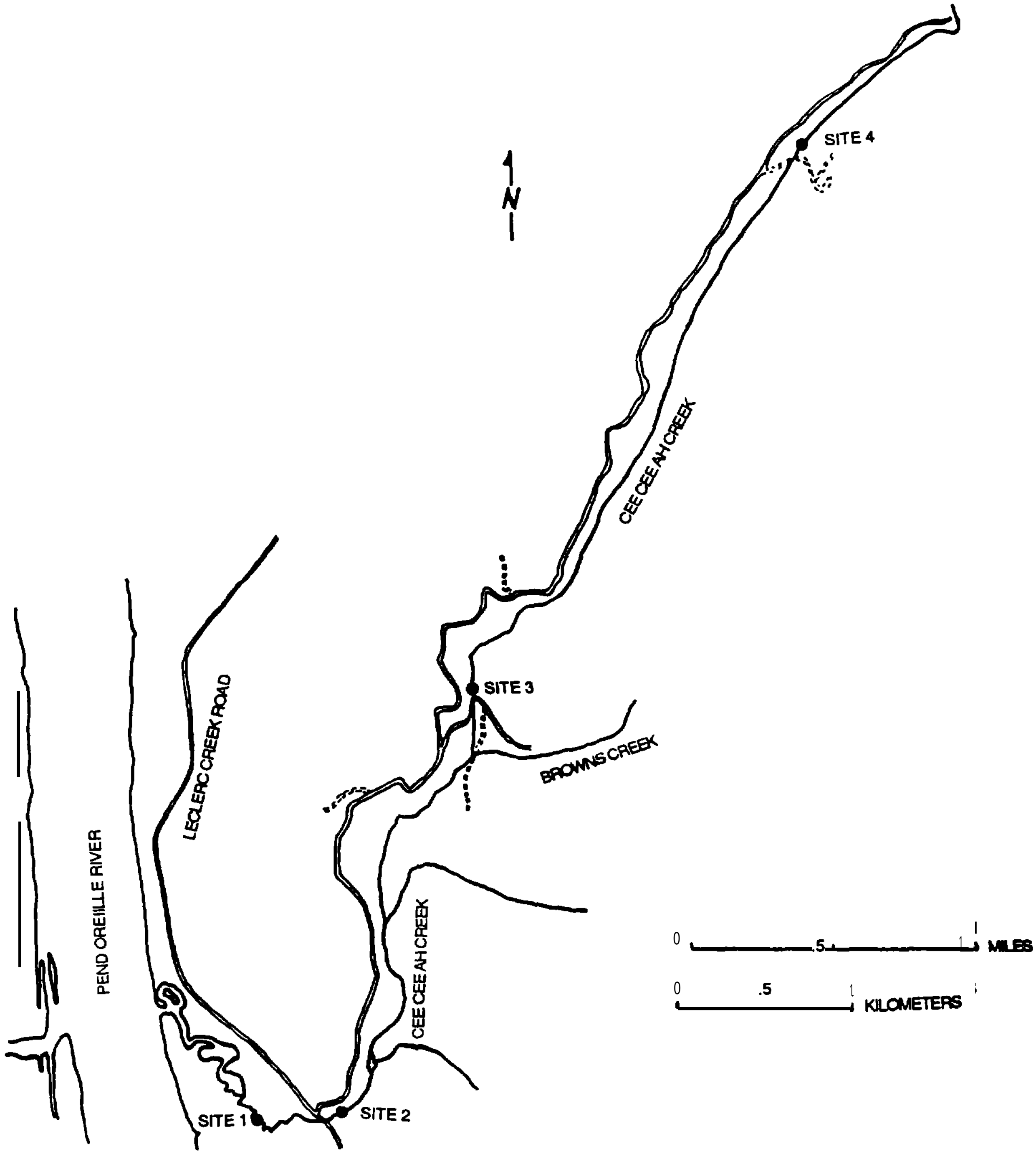

Figure 2.4 Map of Cee Cee Ah Creek showing the locations of population study sites.

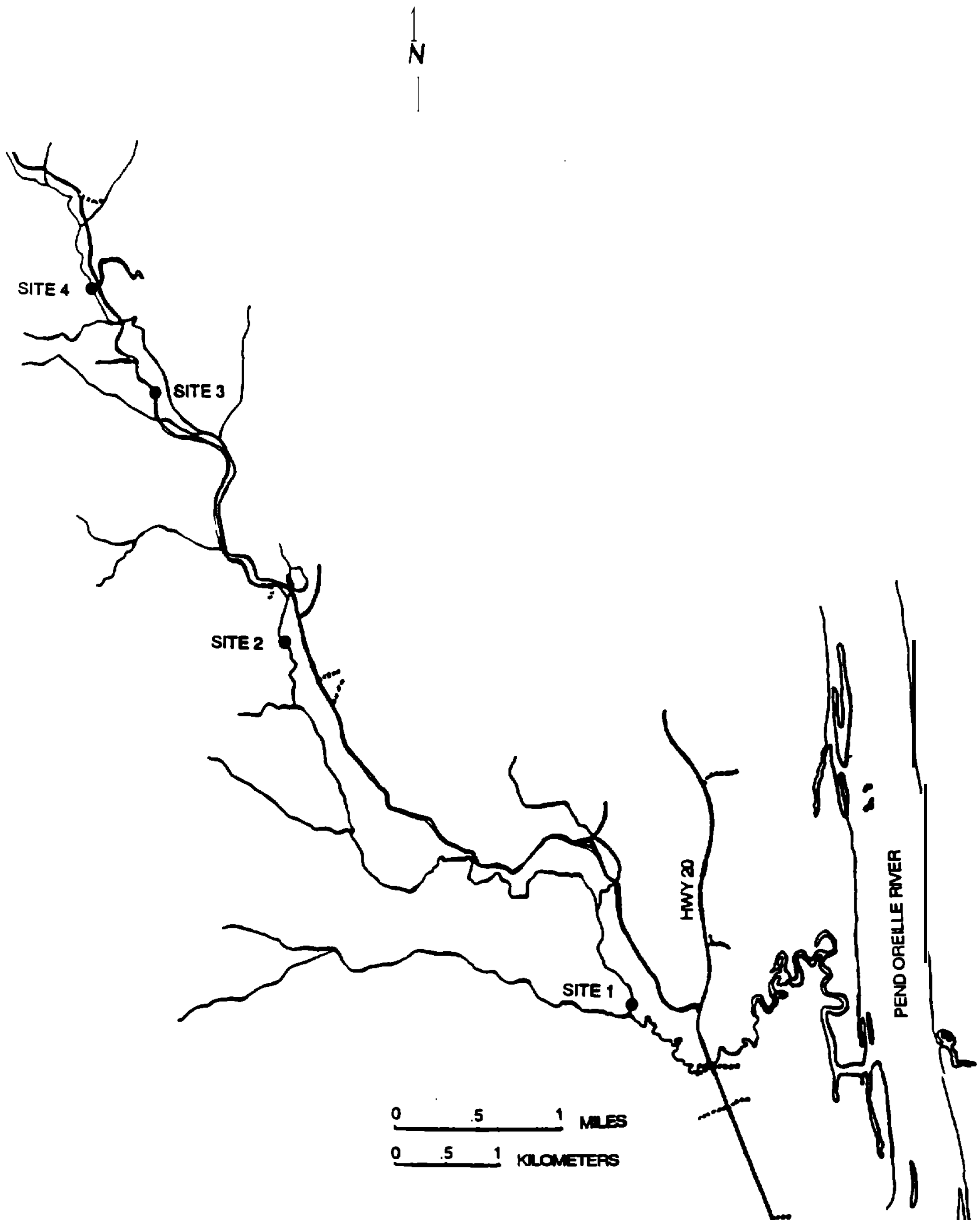

Figure 2.5 Map of Tacoma Creek showing the locations of population study sites.

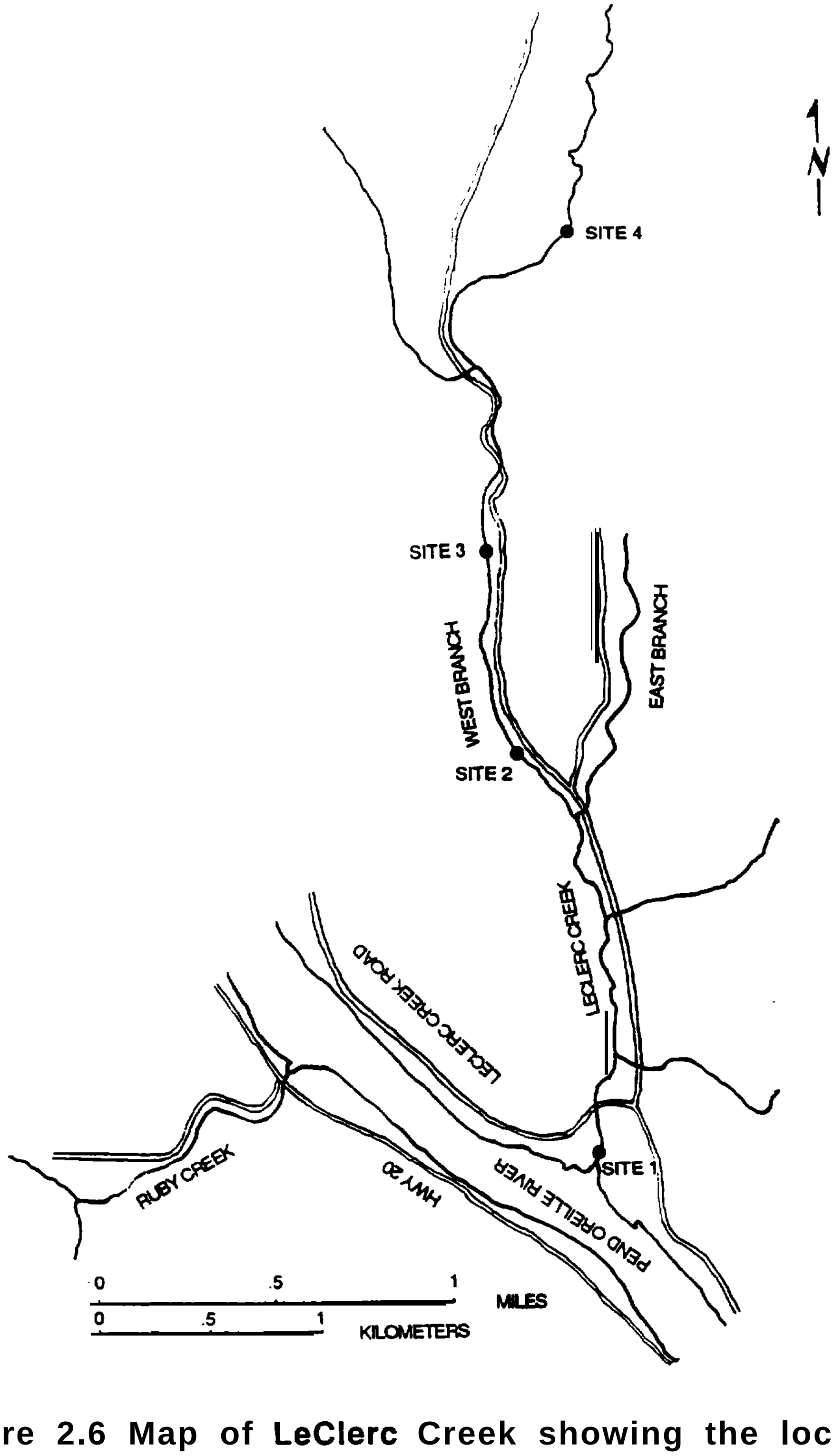

Figure 2.6 Map of LeClerc Creek showing the locations of population study sites.

A population estimate was conducted on Ruby Creek in July, 1988 using the removal-depletion method. Two sections, one 49 m in length and one 61 m in length, were sampled (Fig. 2.7).

2.4.1.1 PETERSEN ESTIMATES

Fish captured during the initial sampling trip were identified, enumerated, measured to the nearest millimeter, and given a site specific fin clip. Some were given an additional Floy FTE-69 numbered fingerling tag or a Floy FD-68B anchor tag. A scale sample was removed from a representative sample of fish during the marking period for age and growth determination. Fish were released in the same area as they were captured. Two or three days after the fish were marked, a second electrofishing trip was conducted using the same procedures and the number of marked and unmarked fish caught was recorded.

The four sample sections in each tributary were combined to get the population for the 800 yards sampled. The population for the 800 yard sections sampled was estimated using the equation:

$$N = \frac{mC}{r},$$

where: N = estimated population size;
m = number of fish marked;
C = total number of fish caught in the second sample; and
r = number of marked fish caught in the second sample.

The accuracy of the estimate was determined by calculating the standard error of the estimate using the equation:

$$S.E.(N) = N\sqrt{\frac{(N-m)(N-c)}{mC(N-1)}},$$

where: S.E.(N) = standard error of the population estimate.

Ninety-five percent confidence intervals (C.I.) were placed around the estimate by multiplying the standard error of the estimate by 1.96. This yielded a range around the estimated

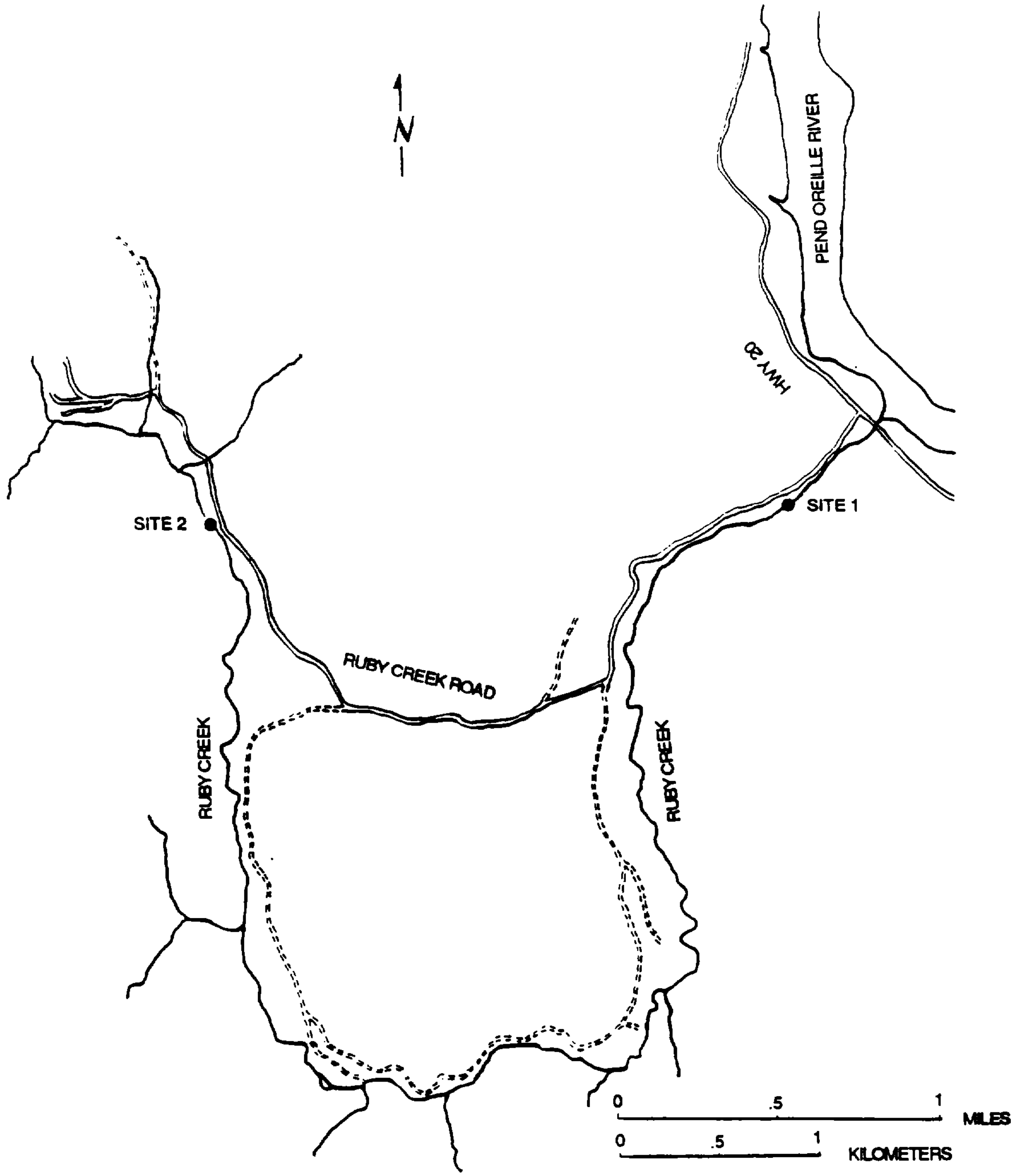

Figure 2.7 Map of Ruby Creek showing the locations of population study sites.

population ($N \pm C.I.$). There was a 95 percent chance that the actual population fell within this range.

The population estimate and confidence intervals were expanded for the entire length of the stream by dividing the distance sampled into the length of the tributary to yield an expansion factor. The length of each tributary was obtain from USGS 7.5 minute topographic maps using a map wheel. The population estimate and confidence intervals were then multiplied by the expansion factor to yield an estimate for the entire stream.

2.4.1.2 REMOVAL-DEPLETION ESTIMATE

Two electrofishing passes were made for each 200 yard section of LeClerc Creek. Fish captured in the first pass were held in buckets until the second pass was completed. Captured fish were identified, enumerated, measured to the nearest millimeter, and some were tagged with a Floy FTE-69 numbered fingerling tag or a Floy FD-68B numbered anchor tag.

The data collected from the four sections was combined and the population was estimated for the 800 yards sampled using the following equation of Seber and LeCren (1967):

$$N = \frac{(U_1)^2}{(U_1 - U_2)},$$

where: N = estimated population size;
U_1 = number of fish collected in the first pass; and
U_2 = number of fish collected in the second pass

The standard error of the estimate was calculated by:

$$S.E.(N) = \sqrt{\frac{(U_1)^2 (U_2)^2 T}{(U_1 - U_2)^4}},$$

where: $S.E.(N)$ = standard error of the population estimates: and
T = total number of fish collected $(U_1 + U_2)$.

Ninety-five percent confidence intervals were placed around the estimate by multiplying the standard error by 1.96.

The population estimate and confidence intervals were expanded for the entire length of the stream by dividing the distance sampled into the length of the tributary to yield an expansion factor. The length of each tributary was obtain from USGS 7.5 minute topographic maps using a map wheel. The population estimate and confidence intervals were then multiplied by the expansion factor to yield an estimate for the entire stream.

2.4.2 RIVER AND SLOUGHS

Fish populations were estimated in the river and sloughs using the Schnabel multiple census as described by Ricker (1975). Using this method populations can be estimated by conducting the fish marking and recapturing at the same time using the following formula:

$$N = \frac{\sum_{t=1}^{n} (C_t M_t)}{R},$$

where:
- N = estimated population size;
- C_t = total number of fish caught at time t;
- M_t = total number of marked fish at large at the start of sampling at time t;
- R = total number of recaptures during all sampling periods; and
- n = number of sampling periods.

The 95 percent confidence range was placed around the estimate by treating R as a Poisson variable and using the table found in Appendix A of Ricker (1975) to get the upper and lower confidence limits for R. The values from the table were then substituted for R in the above equation to get the upper and lower confidence limits for the population estimate.

Fish populations were estimated for all species for which there was at least one recapture during the March through October samplings. Only fish one year and older (as determined from back-calculated lengths) were included in the estimate to exclude fish hatched during the census. Marked fish that died during recapture and tagged fish harvested by anglers were subtracted from the number of marked fish at large for the next sample period. The number of fish caught and the number of recaptures from all transects were combined to make population estimates for the river. Population estimates and confidence limits were then expanded for the river by multiplying the approximate distance sampled at each study site (0.4 km) times the number of river sites (11) and expanded for the entire 90 km of the river. If a species was typically caught only in a few locations (e.g., brown trout) then the population was only estimated for those individual locations.

During some months the same study site was sampled more than once. If a fish was recaptured in the same month it was tagged it was not included as being recaught or as a recapture for estimating the population for the river. In doing this, each month was treated as a sample period. Largemouth bass, mountain whitefish, and brown trout populations were estimated at some selected locations where they were frequently caught and there were sufficient recaptures. For these estimates each sample time was used as a separate sample whether they occurred in the same month or not.

During 1989 a study will be conducted to determine if mortality rates differ significantly between tagged and non-tagged fish.

2.5 AGE, GROWTH, AND CONDITION

Scale samples were collected by following the methods of Jearld (1983). In the laboratory, several scales were mounted between two glass microscope slides and viewed using a Realist, Inc., Vantage 5 microfiche reader. The age was determined by counting the number of annuli (Lux 1971, Jearld 1983). Simultaneous to age determination, measurements were made from the center of the focus to the furthest edge of the scale. Along this line, measurements were made to each annulus. The measurements were made to the nearest millimeter under a constant magnification. Annual growth was then back-calculated using the Lee method as described by Carlander (1981). This method involved the use of the formula:

$$L_i = a + \left(\frac{L_c - a}{S_c}\right) S_i ,$$

where: L_i = length of fish (in mm) at each annulus;
a = intercept of the body-scale regression line;
L_c = length of fish (in mm) at time of capture;
S_c = distance (in mm) from the focus to the edge of the scale; and
S_i = scale measurement to each annulus.

The intercept (a) was obtained from the regression analysis of body length -v.- scale length at time of capture. This was accomplished using StatView 512+ (Brainpower 1986) on a Macintosh SE computer.

The proportional method of back-calculation was used for some species when small sample sizes led to poor regressions. The following equation was used:

$$L_i = \frac{S_i}{S_c} L_c$$

This method, unlike the Lee method, does not take into account the size of fish at scale formation.

Condition factors were computed as an indicator of the fishes growth pattern and, therefor, an indication of its general condition (Tesch 1971, Everhart and Youngs 1981, Anderson and Gutreuter 1983). The formula to calculate the condition factor is:

$$K_{TL} = \left(\frac{W}{L^3}\right) 10^5 ,$$

where: K_{TL} = condition factor;
W = weight of fish in grams; and
L = total length of fish in millimeters.

Comparisons were made to condition factors in other bodies of water in the Pacific Northwest.

2.6 FOOD AVAILABILITY IN THE RIVER, SLOUGHS, AND TRIBUTARIES

2.6.1 BENTHIC MACROINVERTEBRATE DENSITIES IN TRIBUTARIES AND INVERTEBRATE ABUNDANCE IN THE DRIFT

Benthic macroinvertebrates were collected using a modified Hess-Waters sampler (Hess 1941, Waters and Knapp 1961) with an area of 0.1 m^2 and a net aperture of 390 μm. Samples were collected by pushing the sampler 10 cm into the substrate. The area within the sampler was disturbed to a depth of 8-10 cm to adequately sample the hyporheic community (Hynes 1970, Williams and Hynes 1974). Large rocks were removed from the sampler and organisms removed with a brush. Samples were collected in the riffles since they contain higher invertebrate densities and diversities than pools and runs (Egglishaw and Mackay 1967, Armitage et al. 1974, Scullian et *al.* 1982, O'Laughlin et al. 1988). Three samples were collected in the same area as the fish collections for feeding habits studies in April, June, and July. In September and October two samples were collected at an upstream and downstream site in each tributary, except in Tacoma Creek, where two samples were taken in one area.

Organisms were preserved in 10 percent formalin and later transferred to 70 percent alcohol. Organisms were separated from the substrate by sugar floating (Anderson 1959) three times. The sediment portion was saved and manually sorted to remove any organisms left after floating. Organisms were sorted and identified to family using the keying sources of Borror and White (1970) Borror et *al*. (1976), Baumann et *al.* (1977), Wiggins (1977) Pennak (1978), and Merritt and Cummins (1984).

Two drift samples were collected immediately above the location that fish were sampled in June, July, September, and October. Water depth passing through the sampler was measured using a wading rod. Mean column velocity of the water passing through the sampler was measured directly in front of the sampler at 0.6 of the water depth using a Price pygmy meter (Buchanan and Somers 1980). This made it possible to determine the volume of water passing through the sampler and calculate densities for organisms found in the drift. Samples were preserved in 10 percent formalin and later transferred to 70 percent alcohol. Organisms were sorted and keyed to family using the sources listed above.

The Shannon-Weiner diversity index was used as a measure of the evenness and richness of the invertebrate communities in the tributaries. This indices takes into account not only the number of species, but the number of individuals within each species (Krebs 1985). The equation for the indices is:

$$H=-\sum_{i=1}^{s}(p_i)(\log_2 p_i),$$

where: H = index of species diversity;
s = number of species; and
p_i = proportion of total sample belonging to the i^{th} species.

A high diversity value (i.e., above 3.0) indicates a healthy, stable community while low values may indicate unhealthy conditions.

To determine if there was a significant difference in densities of the top five prey items (as determined from feeding analysis) between the tributaries, the Kruskal-Wallis test (Zar 1984) was performed. The tests were ran on a Macintosh SE using StatView 512+ (Brainpower 1986).

Densities and diversities were compared with those reported for other streams in the Pacific Northwest.

2.6.2 BENTHIC MACROINVERTEBRATE DENSITIES IN THE RIVER AND SLOUGHS

Quantitative samples of benthic macroinvertebrates were collected using a Ponar dredge with an opening of 0.053 m. Grabs were made at three locations along each river transect at one quarter, half, and three quarters of the way across the river. Three grabs were made in each slough just inside the mouth, about halfway in, and near the end of the slough. Grabs were collected during the same sampling period as fish stomachs.

The grabs generally were made up of a sand or silt/mud substrate. The excess water was poured off and a subsample of 10 percent by weight was taken after thoroughly mixing the sample. Organisms were then separated from the sand substrate by sugar flotation (Anderson 1959). Samples were floated two or three times depending upon the size of the sample. The sediment portion was retained and manually sorted to remove organisms retained in the sediment. Silt/mud grabs were washed through a U.S. Standard No. 30 sieve to remove the sediment. All samples were preserved in 10 percent formalin and later transferred to **70** percent alcohol.

Organisms were sorted and identified to family with the taxonomic keys listed in 2.6.1. Organisms obtained from the dredge samples were converted to number per square meter.

Densities and diversities found in the Pend Oreille were compared with other rivers and reservoirs in the region.

2.6.3 ZOOPLANKTON

Zooplankton samples were collected by making a vertical tow from the bottom to the surface using a Wisconsin plankton net with an 80 µm silk net and bucket. The organisms were collected in mid-channel at each river transect during the same period as fish stomach collection. The organisms were washed into a 253 ml bottle containing 10 ml of 37 percent formaldehyde. Organisms were stained with 1 .O ml of five percent Lugol's solution and 1 .O ml of saturated eosin-y ethanol stain.

In the laboratory, zooplankton were identified to genus and species when possible, using the keys of Brooks (1957) Edmondson (1959), Brandlova et *al.* (1972), Ruttner-Kolisko (1974), Pennak (1978), and Steinberger (1979). A Nikon SMZ-10 dissecting microscope with a ring illuminator system and Nikon phase contrast microscope were used for making identifications. A minimum of three subsamples was counted using a modified counting chamber (Ward 1955) until 100 organisms or 25 ml of the sample had been counted (Edmondson and Windberg 1971, Downing and Rigler 1984).

The counts for each species in each subsample were recorded in Microsoft Excell on a Macintosh SE computer. Densities (number of organisms per liter) was calculated in this program utilizing three equations. First, the volume of the sample was calculated by the following equation:

$$V = \pi r^2 h,$$

where: v = volume;
r^2 = radius of sampler; and
h = depth of sample.

Second, the multiplication factor for each set of samples was calculated using the number of subsamples taken, the volume of the subsample, the volume of the entire sample, and the dilution used. The following equation was used:

$$MF = \frac{\left(\frac{1}{Sn} x \frac{SV}{SSV}\right)}{V} DF,$$

where: MF = multiplication factor;
Sn = number of subsamples;
sv = sample volume;
ssv = subsample volume; and
DF = dilution factor.

Finally, the density (number of organisms per liter) for each sample was calculated by the following equation:

$$D = MF x Tn,$$

where: D = density (number of organisms per liter); and
Tn = total number of each group of organisms.

The lengths of predominant cladocerans were measured from the top of the head to the base of the carapace, excluding the spine. Cladoceran biomass was determined using the length weight regression equations summarized by Downing and Rigler (1984). These regression equations were developed from various studies during the time period 1972-1982. If more than one regression equation was available for an organism then the regression equation with a mean length closest to the mean length of that organism in this study was used. The length-weight regression equation, the equations used for each species, and sources of the equations are listed in Table 2.2. After the mean weight of an organism was calculated with the appropriate equation, the total weight of the organisms in the sample was calculated by multiplying the mean

Table 2.2. Length-weight relationships for crustacean zooplankton (Cladocera) collected from the literature as summarized by Downing and Rigler (1984). The slope (b), intercept (*ln* a), and range of length measurements (mm) are presented for the relationship:

$$\ln w = \ln a + b \ln L,$$

where: $\ln w$ **= the logarithim of the dry weight estimate (μg); and**
L = total length from top of the head to the base of the carapace.

Species	*ln* a	b	Range	Reference
Daphnia retrocurva	1.4322	3.129	0.50-2.00	Rosen (1981)
Daphnia galeata	1.51	2.56	---	Dumont et al. (1975)
Ceriodaphnia reticulata	3.0727	3.29	---	O'Brien and deNoyelles (1974)
Diaphanosoma brachyrum	1.2894	3.039	0.40-l .20	Rosen (1981)
Bosmina longirostris	2.7116	2.5294	0.28-0.54	Bottrell et *al.* (1976)
Chydorus sphaericus	4.5430	3.836	0.20-0.40	Rosen (1981)
Leptodora kindtii	-0.8220	2.670	1 .oo-5.00	Rosen (1981)

weight of the organism by total number of those organisms in the sample.

2.7 FEEDING HABITS

2.7.1 FIELD COLLECTION METHODS

Stomachs were collected, at each study site, from target species in April, June, July, September, and October, 1988. Upon capture each fish was identified, measured to the nearest millimeter, and weighed to the nearest gram. A scale sample was removed for age determination and back-calculation of growth. The body cavity was opened and sex was noted, when distinguishable. The stomach was removed by cutting posterior to the pyloric sphincter and at the anterior portion of the esophagus and preserved in 10 percent formalin.

2.7.1 .I TRIBUTARIES

Tributary stomach samples were collected, using a Smith-Root Type VII pulsed DC backpack electrofisher, at one location in April, June, and July. In these early samples, brown trout were predominant if the stomach samples were collected in the lower reaches of the tributary and brook trout were predominant if stomachs were collected in the upper reaches. To eliminate this sample bias, in September and October, stomachs were collected at two locations to account for the longitudinal variation in species distribution in Cee Cee Ah, Skookum, and LeClerc Creeks. One sample was collected in Tacoma Creek since the predominant species was brook trout wherever it was accessible. Ten stomachs were collected from various sizes of the predominant species in each location. Stomachs were also collected from any incidental species captured at each location.

2.7.1.2 RIVER AND SLOUGHS

Fish were collected at each study site using a Smith-Root SR-18 boom electrofisher, gill nets, and beach seines. The goal was to take ten stomachs from a variety of sizes of each species at each transect. This was not possible for some species at some transects simply because ten fish of each species were not captured.

Largemouth bass in excess of approximately 200 mm were anesthetized with TMS and their stomach contents removed by injecting water into their stomach using a garden sprayer with a hose attachment (Light et al. 1983). Stomach contents were collected on a No 45 sieve (355 µm) and placed in 10 percent formalin. Fish that sometimes remained in the stomach were removed by using forceps or fingers. The bass were allowed to recover, tagged, and released.

2.7.2 LABORATORY METHODS

In the laboratory, the stomachs were transferred to 70 percent isopropyl alcohol and the stomach contents were identified to family using a Bausch and Lomb Stereozoom 5 or Nikon SMZ-1B dissecting microscope with fiber optic illuminator and keys of Borror and White (1970), Borror et al. (1976), Baumann et al. (1977), Wiggins (1977) Pennak (1978), and Merrit and Cummins (1984). Once the prey items were grouped to family, they were counted and dry weights obtained by drying in an oven for 24 hours at 105 °C and weighed to the nearest 0.1 mg on a Sartorious model H51 balance (Weber 1973).

Stomachs containing large numbers of zooplankton were subsampled following the methodology described by Weber (1973). Minor food items were removed and counted leaving the dominant food group. Cladocerans were identified to family and copepods to suborder. The dominant food group was then placed into a beaker and the volume brought up to 100 ml. The beaker was stirred to completely randomize the sample. Three 2 ml aliquotes were then taken and counted. The total number of zooplankton in the group was calculated by using the formula:

$$\text{Total No.} = \frac{\sum_{n=1}^{3}\left(\frac{DV}{SV} \times Tn\right)}{3}$$

Where: DV = total diluted volume (100 ml);
SV = total subsample volume (2 ml); and
Tn = total number of the particular species of zooplankton in the sample.

2.7.3 DATA ANALYSIS

The number and weight of each prey group found in the stomach of each fish was placed into a computer file using Microsoft Excell on a Macintosh SE. River and slough stomachs were combined and each tributary was analyzed individually. Mean number, mean weight, and frequency of occurrence (i.e., presence/absence) were computed for each age class of each species for each month. Since stomachs were collected once in the spring (April), twice in the summer (June and July), and twice in the fall (September and October), the summer and fall samples were averaged to yield seasonal means. The April, summer, and fall means were then averaged to describe the annual feeding habits. By taking the mean of the seasonal means, biases introduced due to unequal sample sizes were eliminated.

2.7.3.1 INDEX OF RELATIVE IMPORTANCE

Frequency of occurrence, mean number, and mean weight of prey groups in the stomach contents are biased if used individually to assess the bioenergetic contribution of a particular prey group to a fishes metabolic requirements (Windell 1971, Bowen 1983). For example, frequency of occurrence is the proportion of stomachs that contained a particular prey group. It does not take into account the number or biomass of each prey group. The prey group may be frequently found in fish stomachs, thus yielding a high frequency of occurrence, yet they may be few in number or small in size, therefor, not contributing significantly to the dietary needs of the fish. Numerical proportions overemphasize the importance of small prey groups that may be present in large numbers but may have a lower nutritional value than large prey groups that are present in lower numbers. Since nutritional value is approximately proportional to weight, percent by weight is used to determine a prey groups importance in the fish diet, however, it takes more time for a fish to locate, capture and digest larger prey. Percent by weight may overemphasize the relative importance of large prey items that are found infrequently (Bowen 1983).

The Index of Relative Importance (George and Hadley 1979) combines the frequency of occurrence, percent by number, and percent by weight into an index intended to compensate for the biases of each alone. The IRI was calculated by:

$$RI_a = \frac{100\ AI_a}{\sum_{a=1}^{n} AI_a},$$

where: RIa = relative importance of food item a;
AIa = absolute importance of food item a (*i.e,* frequency of occurrence + numerical frequency + weight frequency of food item a: and
n = number of different food types.

The relative importance values range from 0 to 100 percent with prey groups near zero being relatively less important than prey groups near 100.

2.7.3.2 DIET OVERLAP INDEX

Diet overlap indices were calculated using the equation of Horn (1966):

$$C_x = \frac{2\sum_{i=1}^{n}(P_{xi} \times P_{yi})}{\sum_{i=1}^{n} P_{xi}^2 + \sum_{i=1}^{n} P_{yi}^2},$$

where: C_x = the overlap coefficient;
Pxi = the proportion of food category i in the diet of species x;
P_{yi} = the proportion of food category i in the diet of species y; and
n = the number of food categories.

The overlap coefficients were computed by using the IRI values in the equation for the variables P_{xi} and P_{yi}. The overlap coefficients range from 0 (no overlap) to 1 (complete overlap). Values of less than 0.3 are considered low and values greater than 0.7 indicated high overlap (Peterson and Martin-Robichaud 1982). High diet overlap indices may indicate competition if the food items utilized by the species are limited (MacArthur 1968). High diet overlap indices may also indicate that there is an abundant food supply and competition does not exist.

2.7.3.3 ELECTIVITY INDEX

Electivity indices were computed to compare the abundance of food groups in the diet to the abundance of those food groups in the environment. Densities of invertebrates in the benthos and drift and zooplankton densities in the environment were converted to proportions, and along with the numerical proportion of the prey groups in the stomach were used in a linear index of Strauss (1979). Some advantages of using this index are; (1) while the use of any indices requires adequate sample sizes, this index is not biased by unequal sample sizes, (2) extreme values are obtained only when a prey item is very abundant in the environment and rare in the diet or when a prey item is rare in the environment and very abundant in the diet, (3) it is distributed approximately normally, and (4) statistical comparisons can be made between calculated values (Strauss 1979). The equation for the linear food selection index was:

$$L = r_i - p_i,$$

where: L = the measure of food selection;
r_i = the relative abundance of prey i in the gut;
p_i = the relative abundance of same prey i in the environment.

Food selection values ranged from +1 to -1. Values near zero indicate that the fish is feeding on that prey group in relation to its abundance, or randomly. Positive values indicate that the fish are selecting those prey groups. Negative values indicate that the fish are avoiding those prey groups, or the prey are not accessible, protectively camouflaged, or hard to catch.

2.8 FISH MOVEMENT AND MIGRATION

Fish were tagged during collection of relative abundance and population data (see sections 2.3 and 2.4) with site specific or numbered floy tags. Tagged fish captured in subsequent sampling trips or caught by anglers provided information about fish movements.

2.9 HABITAT UTILIZATION

Two types of habitat information were collected. The first type consisted of recording information about the habitat electrofished during the collection of relative abundance/population information. General observations were made about depth, substrate, water velocity, and cover. The second type of habitat utilization information was collected in June and July making habitat measurements wherever fish were captured by electrofishing with the electrofishing boat. Depth and velocity measurements were made with a boat mounted boom with an attached sounding reel, Price AA current meter, and 50 lb sounding weight. Depth was measured by first lowering the sounding weight to the water surface and zeroing the depth indicator on the reel. The weight was then lowered to the bottom and the depth recorded to the nearest 0.1 ft off the indicator. No adjustments were necessary **to** correct for weight drift since the currents were not sufficient to cause drift downstream. Mean column velocity was measured using the two point method (0.2 and 0.8 of the total depth) when depths were greater than 2.5 ft and the one point method (0.6 of the total depth) when depths were less than 2.5 ft (Buchanan and Somers 1980). When using the two point method, the two velocities were averaged to get mean column velocity.

Substrate was categorized according **to** Table 2.3 a mixture of two substrate types were categorized according to the relative percentage of each type. For instance, a substrate code of 2.8 represents a mixture containing 20 percent sand and 80 percent gravel.

Cover was categorized according to Table 2.4 and 2.5. Cover was broken down into small and large object, overhead, combination, and aquatic macrophytes. If aquatic macrophytes were present Table 2.5 was used in their categorization. This system made it possible to account for the density of the macrophytes as well as the type of macrophytes composing the weed bed.

The amount of data collected in 1988 made it impractical to construct habitat suitability curves. Additional data collected in 1989 and 1990 will be added to the current data base and will be used to construct utilization curves according to the guidelines of **Bovee (1986). Habitat availability information collected in 1989** will be used to adjust the utilization curves to get preference curves.

Table 2.3. Scale used to categorize substrates in the Pend Oreille River.

SUBSTRATE CODE	DESCRIPTION	SIZE (MM)
1	SILT/MUD	c 0.062
2	SAND	0.062-2.0
3	GRAVEL	2.0-64.0
4	SMALL COBBLE	64.0-I 28.0
5	LARGE COBBLE	128.0-256.0
6	BOULDER	>256.0

Table 2.4. Cover codes used to categorize cover in the Pend Oreille River.

COVER CODES	DESCRIPTION	
0	NO COVER	
1	SMALL OBJECT	
2	LARGE OBJECT	>60 cm in length and >15 cm in diameter or >30 cm in diameter
3	OVERHEAD COVER	<45 cm from the water surface
4	COMBINATION OF OBJECT AND OVERHEAD	
5	MACROPHYTES	(see Table 2.5)

Table 2.5. Codes used to categorize macrophytes in the Pend Oreille River.

MACROPHYTE CODE	DESCRIPTION
1_.__	MACROPHYTES RESTRICTED TO BOTTOM
2_.__	MACROPHYTES EXTENDING FROM BOTTOM TO MID-WATER
3-*--	MACROPHYTES EXTENDING ABOVE MID-WATER
_1.__	MCAROPHYTES SPARSE
_5.__	MACROPHYTES MODERATE
_9.__	MACROPHYTES DENSE
__.1_	ELODEA DOMINANT
__.2_	POTAMOGETON DOMINANT
__.3_	CERATOPHYLLUM DOMINANT
__.4_	MYRIOPHYLLUM DOMINANT
__._0	NO SUBDOMINANT
- - -1	ELODEA SUBDOMINANT
__._2	POTAMOGETON SUBDOMINANT
- - -3	CERATOPHYLLUM SUBDOMINANT
__._4	MYRIOPHYLLUM SUBDOMINANT

2.10 CREEL SURVEY

The Pend Oreille River creel survey was designed to:

(1) estimate total angler effort along the Box Canyon portion of the Pend Oreille River from Albeni Falls dam to Box Canyon dam:
(2) determine catch per unit effort (CPUE) for boat and shore anglers;
(3) estimate the annual harvest for each fish species;
(4) obtain information on fish migration patterns in the Pend Oreille River;
(5) collect length and weight data on fish checked during creel surveys: and
(6) obtain information on angler use patterns (Le., time of day most heavily fished, seasonal variations in angler preferences, etc.).

The river was divided into three sections (Fig. 2.8). Section **1** extended from Albeni Falls Dam to the Usk bridge (29.6 km). Section 2 ran from the Usk bridge to Panhandle Park (23.7 km). Section 3 went from Panhandle Park to Box Canyon Dam (36.2 km). Each section was further divided into subsections to determine areas of high angler usage and to obtain information about fish movements by identifying the location of tagged fish recovered by anglers.

The days in the month were divided into weekdays and weekend days (including holidays). Holidays included all officially declared federal holidays. The day was then divided into two time periods. The AM time period went from sunrise to 1 PM. The PM time period went from noon to sunset. The times of sunrise and sunset were obtained from sunrise/sunset tables compiled for Spokane, WA (Nautical Almanac Office, U.S. Naval Observatory, Washington, D.C.).

During each AM and PM creel period, two randomly timed progressive angler pressure counts were conducted. These pressure counts were made by automobile with the direction of travel randomly selected. Virtually all of the river can be observed from points along the road. The number of boats and shore anglers within the section was recorded. Automobile pressure counts were checked for accuracy by conducting four simultaneous pressure counts by automobile and fixed-wing aircraft.

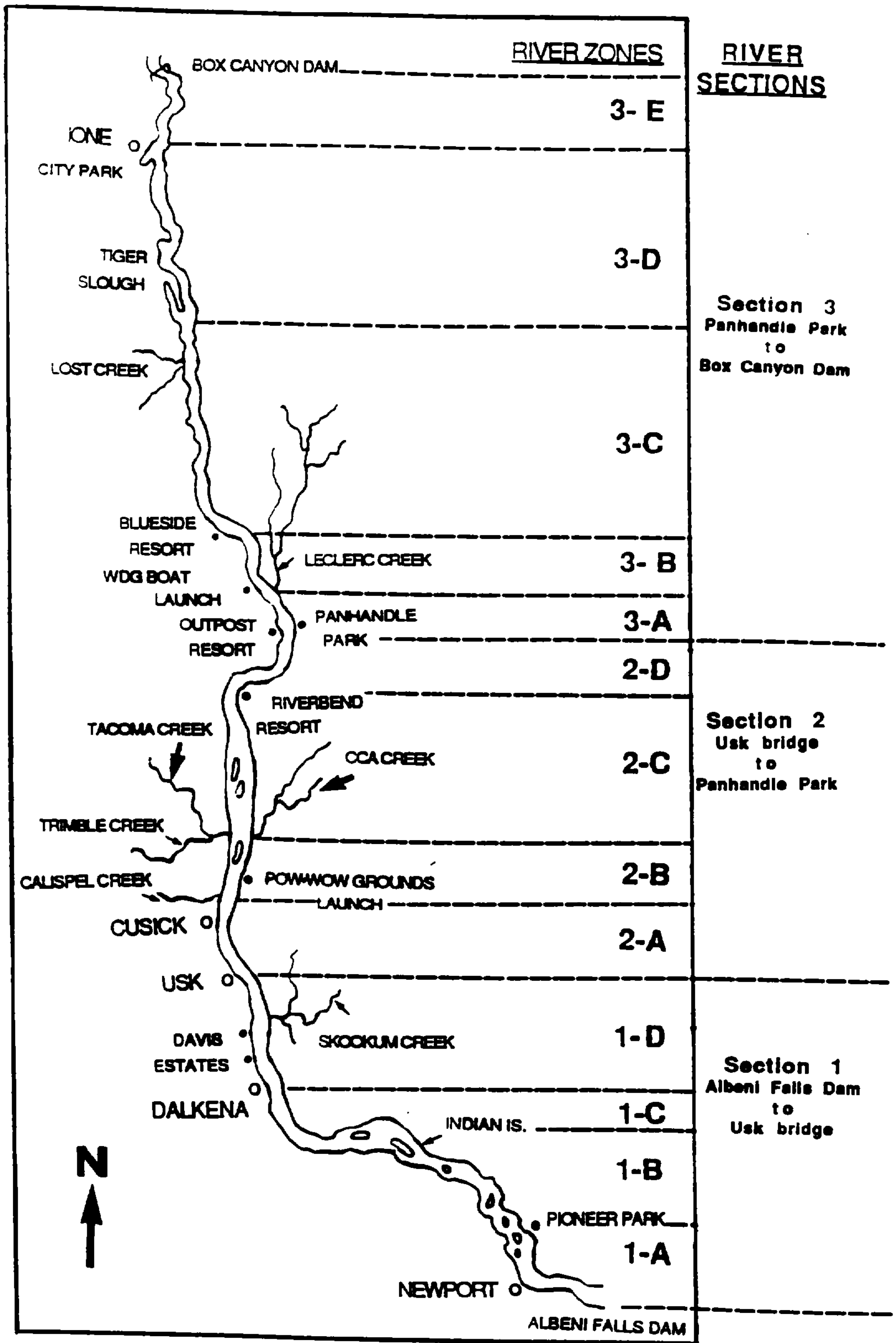

Figure 2.8 Map of Pend Oreille River study area showing major river sections and river zone designations utilized in creel surveys.

Angler interviews were conducted to obtain information about the number of anglers per boat, the total number of hours fished, the species of preference, the type of angler (boat or shore), the number of each species caught and kept or released, the river zones fished, and whether any tagged fish were caught. Anglers were encouraged to submit information on fish they caught that were tagged. Information requested included: tag number and color; species; date of capture; location of capture; fish length; and weight (if possible). If a tagged fish was kept the angler was requested to return the tag along with the above information. Posters were put up at resorts, boat launches, and campgrounds to inform the public of the study and where to send information on tagged fish. Two presentations were made to local bass clubs to inform them of the study and to coordinate bass tagging with their tournaments.

Creel clerks requested that each angler allow them to examine any fish (if possible) they had caught to obtain the species, length, weight, sex, and to remove a scale sample for age determination. Creel clerks also inspected the fish for fin clips or tags.

Pressure was estimated monthly for each river section, day type, angler type, and time period by the formula:

$$PE_s = N_s X_s,$$

where: PE_s = pressure estimate for stratum;
N_s = number of hours in stratum; and
X_s = mean number of anglers in stratum.

Total pressure for a given month was estimated for each river section by:

$$PE_m = \sum_{i=1}^{n} PE_{si},$$

where: PE_m = pressure estimate for the month;
n = number of strata.

The variance of the pressure estimate for each stratum was calculated by:

$$VPE_s = \frac{N_s}{n} S_s^2,$$

where: VPE_s = variance of the pressure estimate for each stratum
N_s = number of hours in stratum;
n = number of hours sampled in the stratum; and
S_s = standard deviation of the mean number of anglers in the stratum.

The monthly variance of the pressure estimate for each river section was calculated by:

$$VPE_m = \sum_{i=1}^{n} VPE_{si},$$

where: VPE_m = monthly variance of the pressure estimate; and
n = number of strata.

The monthly pressure estimate and variance for the river was completed by summing the pressure estimates and variances for each river section. Similarly, the annual (March through December) pressure estimate and variance was calculated by summing the monthly pressure estimates and variances.

The 95 percent confidence interval for the pressure estimate was calculated by:

$$C.I. = PE \pm \sqrt{VPE} \times 1.96$$

Catch per unit effort (CPUE) was calculated for each species of fish caught, whether the fish was kept or released, and for each species of fish caught and kept. CPUE was calculated by dividing the number of fish caught by the number of hours spent fishing by interviewed anglers.

Harvest was estimated by multiplying the CPUE times the pressure estimate. By multiplying the CPUE times the upper and lower confidence interval for the pressure estimate the confidence interval for the harvest estimate was obtained.

Information was obtained from the Washington Department of Wildlife and the Inland Empire Bass Club pertaining to past bass tournaments. This information was analyzed to determine trends in CPUE and the mean size of the catch.

3.0 RESULTS

3.1 RELATIVE ABUNDANCE

During March through October, 1988, a total of 54.3 shocking hours were spent collecting relative abundance information by electrofishing. The hours were the actual number of hours the shocker was on and crews were collecting fish. It does not include processing time. A total of 19,931 fish were collected (Table 3.1). Yellow perch was the most abundant species caught making up 42.1 percent of the total catch (Table 3.2). Pumpkinseed was the second most abundant at 19.0 percent followed by tench (9.6%), largemouth bass (7.2%), northern squawfish (5.3%), largescale sucker (4.8%) mountain whitefish (4.3%) longnose sucker (3.6%), brown bullhead (1.3%) black crappie (1.3%), peamouth (0.6%), brown trout (0.6%), cutthroat trout (0.05%), redside shiner (0.05%), sculpin (0.03%), rainbow trout (0.03%), brook trout (O.Ol%), and bull trout (0.01%). From Table 3.2 it can be seen that yellow perch was the most abundant species at all sites except 1 B and 2. At site 1 B pumpkinseed was most abundant (53.7%), followed by largemouth bass (15.6%), and yellow perch (13.7%). At site 2, mountain whitefish predominated (22.5%), followed by northern squawfish (22.5%), and yellow perch (19.0%). Only in March and June were yellow perch not the most abundant species in the electrofishing surveys (Table 3.3). In March, tench was most abundant making up 23.9 percent of the catch followed by yellow perch at 18.4 percent. In June, pumpkinseed was most common at 38.9 percent followed by yellow perch at 37.2 percent. The monthly relative abundance data, by transect, can be found in Appendix B, Tables B.I-B.8.

Table 3.4 shows the breakdown of the electrofishing relative abundance data for each species by age. The fish were assigned an age based upon their length using the back-calculated lengths at the end of each years growth (see section 3.3.2). Brown bullheads were grouped by length increments since they were not aged. Of the 1434 largemouth bass captured during the study 140 (9.8%) were 0+, 233 (16.2%) were 1 +, 421 (29.4%) were 2+, 285 (19.9%) were 3+, 57 (4.0%) were 4+, 61 (4.2%) were 5+, 78 (5.4%) were 6+, 69 (4.8%) were 7+, 21 (1.5%) were 8+, 19 (1.3%) were 9+, 7 (0.5%) were IO+, 28 (2.0%) were1 I+, 0 (0.0%) were 12+, 1 (0.1 %) was 13+, and 14 (1.0%) were 14+. Of the 8,390 yellow perch caught 68 (0.8%) were 0+, 137 (1.6%) were I+, 769 (9.2%) were 2+, 2019 (24.1%) were 3+,

Table 3.1. Total number of fish caught by electrofishing at each of the study sites during March through October, 1988.

Site Number	1	1A[1]	1B[2]	1C[3]	2	3	3A	4	4A	4B[4]	5	5A[5]	5B[6]	6
Bull trout					1									
Cutthroat trout	5				3		1				1			
Brown trout	12				12	5	50	1			6	2		3
Brook trout					1									
Rainbow trout	2				2			1	1					
Mountain whitefish	56	3		14	350	17	81	15	6	1	23	10	4	9
Largemouth bass	128	7	25	1	71	39	68	43	178	59	43	138	55	61
Black crappie	23		3		28	6	20		37	26	2	14	7	3
Pumpkinseed	190	18	86	16	79	106	135	257	468	66	151	375	155	157
Yellow perch	334	29	22	38	296	678	412	606	615	100	462	428	53	506
Longnose sucker	2	3		1	49	33	198	22	51	1	9	22	4	32
Largescale sucker	246	10	2	4	251	26	50	36	14	1	54	12	13	37
Brown bullhead	13	2	1		7	15	14	14	30	12	9	28	2	11
Tench	74	5	14	8	47	84	119	72	179	63	118	137	38	86
Northern squawfish	322	5	6	20	349	18	29	14	20	2	17	3	11	13
Peamouth	20	3	1	2	4	14	33	9	10	4	2	6	8	2
Redside shiner	11													
Sculpin	2				4									
TOTAL	1440	85	160	104	1554	1041	1210	1090	1609	335	897	1175	350	920

1 Sampled in June
2 Sampled in March and June
3 Sampled in May
4 Sampled in March, April, and May
5 Not sampled in July and August
6 Sampled in May and September

Table 3.1. (cont.)

Site Number	6A	7	7A[7]	7B[8]	8	8A[9]	8C[10]	9	9A[10]	10	10A[11]	11	11A[12]	TOTAL
Bull trout														1
Cutthroat trout												1		11
Brown trout	1	1			1	10	3	5		1		1		114
Eastern brook trout														1
Rainbow trout														6
Mountain whitefish	9	20			19	14	3	20	1	40	18	127		860
Largemouth bass	32	104	22	11	67	30	49	57	48	50	1	47		1434
Black crappie	6	7	28				5	3	17	8	4	15		262
Pumpkinseed	181	202	76	30	103	17	101	151	199	123	58	288	3	3791
Yellow perch	266	549	16	17	364	79	376	637	205	620	97	514	71	8390
Longnose sucker	37	11		9	21	50	47	33	9	36	1	40	2	723
Largescale sucker	20	15		10	16	7	5	18	2	38	7	54	1	949
Brown bullhead	25	9	1	1	3	1	17	1	30	13		9		268
Tench	107	61	19	2	80	7	112	67	159	126	8	127	1	1920
Northern squawfish	10	7	1		6	14	4	18	4	56	22	79	7	1057
Peamouth	2						2	1		3		1		127
Redside shiner														11
Sculpin														
TOTAL	696	986	163	80	680	229	724	1011	674	1114	216	1303	85	19,931

[7] Sampled in April and August
[8] Sampled in September
[9] Sampled in August and September
[10] Sampled in March, April, May, and July
[11] Sampled in March and April
[12] Sampled in April

Table 3.2. Total percent of fish caught by electrofishing at each of the study sites during March through October, 1988.

Site Number	1	1A[1]	1B[2]	1C[3]	2	3	3A	4	4A	4B[4]	5	5A[5]	5B[6]	6
Bull trout					0.1									
Cutthroat trout	0.3				0.2		0.1				0.1			
Brown trout	0.8				0.8	0.5	4.1	0.1			0.7	0.2		0.3
Brook trout					0.1									
Rainbow trout	0.1				0.1			0.1	0.1					
Mountain whitefish	3.9	3.5		13.5	22.5	1.6	6.7	1.4	0.4	0.3	2.6	0.9	1.1	1.0
Largemouth bass	8.9	8.2	15.6	1.0	4.6	3.7	5.6	3.9	11.1	17.6	4.8	11.7	15.7	6.6
Black crappie	1.6		1.9		1.8	0.6	1.7		2.3	7.8	0.2	1.2	2.0	0.3
Pumpkinseed	13.2	21.2	53.8	15.4	5.1	10.2	11.2	23.6	29.1	19.7	16.8	31.9	44.3	17.1
Yellow perch	23.2	34.1	13.8	36.5	19.0	65.1	34.0	55.6	38.2	29.9	51.5	36.4	15.1	55.0
Longnose sucker	0.1	3.5		1.0	3.2	3.2	16.4	2.0	3.2	0.3	1.0	1.9	1.1	3.5
Largescale sucker	17.1	11.8	1.3	3.8	16.2	2.5	4.1	3.3	0.9	0.3	6.0	1.0	3.7	4.0
Brown bullhead	0.9	2.3	0.6		0.5	1.4	1.2	1.3	1.9	3.6	1.0	2.4	0.6	1.2
Tench	5.1	5.9	8.8	7.7	3.0	8.1	9.8	6.6	11.1	18.8	13.2	11.7	10.9	9.3
Northern squawfish	22.4	5.9	3.8	19.2	22.5	1.7	2.4	1.3	1.2	0.6	1.9	0.3	3.1	1.4
Peamouth	1.4	3.5	0.6	1.9	0.3	1.3	2.7	0.8	0.6	1.2	0.2	0.5	2.3	0.2
Redside *shiner*	0.8													
Sculpin					0.3									

[1]Sampled in June
[2]Sampled in March and June
[3]Sampled in May
[4]Sampled in March, April, and May
[5]Not sampled in July and August
[6]Sampled in May and September

Table 3.2. (cont.)

Site Number	6A	7	7A[7]	7B[8]	8	8A[9]	8C[10]	9	9A[10]	10	10A[11]	11	11A[12]	TOTAL
Bull trout														0.005
Cutthroat trout												0.1		0.06
Brown trout	0.1	0.1			0.1	4.4	0.4	0.5		0.1		0.1		0.6
Eastern brook trout														0.005
Rainbow trout														0.03
Mountain whitefish	1.3	2.0			2.8	6.1	0.4	2.0	0.1	3.6	8.3	9.7		4.3
Largemouth bass	4.6	10.5	13.5	13.8	9.8	13.1	6.8	5.6	7.1	4.5	0.4	3.6		7.2
Black crappie	0.9	0.7	17.2				0.7	0.3	2.5	0.7	1.9	1.2		1.3
Pumpkinseed	26.0‘	20.5	46.6	37.5	15.1	7.4	14.0	14.9	29.5	11.0	26.9	22.1	3.5	19.0
Yellow perch	38.2	55.7	9.8	21.3	53.5	34.5	51.9	63.0	30.4	55.7	44.9	39.4	83.5	42.1
Longnose sucker	5.3	1.1		11.3	3.1	21.8	6.5	3.3	1.3	3.2	0.4	3.1	2.3	3.6
Largescale sucker	2.9	1.5		12.5	2.4	3.1	0.7	1.8	0.3	3.4	3.2	4.1	1.2	4.8
Brown bullhead	3.6	0.9	0.6	1.3	0.4	0.4	2.3	0.1	4.5	1.2		0.7		1.3
Tench	15.4	6.2	11.7	2.5	11.8	3.1	15.5	6.6	23.6	11.3	3.7	9.7	1.2	9.6
Northern squawfish	1.4	0.7	0.6		0.9	6.1	0.6	1.8	0.6	5.0	10.2	6.1	8.2	5.3
Peamouth	0.3						0.3	0.1		0.3		0.1		0.6
Redside shiner														0.06
Sculpin														0.03

[7] Sampled in April and August
[8] Sampled in September
[9] Sampled in August and September
[10] Sampled in March, April, May, and July
[11] Sampled in March and April
[12] Sampled in April

Table 3.3. **Number and percent for all fish species collected during relative abundance electrofishing surveys on the Pend Oreille River, WA (March-October, 1988).**

	March	April	May	June	July	August	Sept	October	Total
Shock time (min)	520	546.3	291.7	365	379.3	359.7	479	315	3,256
Yellow perch	258 (18.4)	846 (39.0)	2005 (44.7)	826 (37.2)	1127 (45.7)	1056 (52.1)	1382 (46.4)	890 (40.6)	8390 (42.1)
Pumpkinseed	215 (15.4)	298 (13.7)	1001 (22.3)	862 (38.9)	420 (17.0)	328 (16.2)	431 (14.5)	236 (10.8)	3791 (19.0)
Tench	334 (23.9)	191 (8.8)	550 (12.3)	94 (4.2)	221 (9.0)	109 (5.4)	194 (6.5)	227 (10.4)	1920 (9.6)
Largemouth bass	100 (7.2)	115 (5.3)	249 (5.6)	144 (6.5)	154 (6.2)	160 (7.9)	283 (9.5)	229 (10.4)	1434 (7.2)
N. squawfish	37 (2.6)	120 (5.5)	207 (4.6)	41 (1.8)	170 (6.9)	88 (4.3)	174 (5.8)	220 (10.0)	1057 (5.3)
Largescale sucker	76 (5.4)	181 (8.3)	100 (2.2)	77 (3.5)	172 (7.0)	66 (3.2)	170 (5.7)	107 (4.9)	949 (4.8)
Mountain whitefish	181 (12.9)	262 (12.0)	110 (2.4)	26 (1.2)	45 (1.8)	37 (1.8)	114 (3.8)	85 (3.9)	860 (4.3)
Longnose sucker	95 (6.8)	38 (1.8)	98 (2.2)	69 (3.1)	63 (2.6)	121 (6.0)	136 (4.6)	103 (4.7)	723 (3.6)
Brown bullhead	42 (3.0)	32 (1.5)	72 (1.6)	38 (1.7)	21 (0.8)	5 (0.2)	23 (0.8)	35 (1.6)	268 (1.3)
Black crappie	37 (2.6)	59 (2.7)	56 (1.0)	18 (0.8)	35 (1.4)	15 (0.7)	28 (0.9)	14 (0.6)	262 (1.3)
Peamouth	8 (0.6)	13 (0.6)	29 (0.6)	15 (0.7)	21 (0.8)	13 (0.6)	8 (0.3)	20 (0.9)	127 (0.6)
Brown trout	15 (1.1)	12 (0.6)	5 (0.1)	3 (0.1)	5 (0.2)	27 (1.3)	28 (0.9)	19 (0.9)	114 (0.6)
Cutthroat trout	0 (0.0)	2 (0.1)	2 (0.04)	0 (0.0)	3 (0.1)	1 (0.05)	1 (0.03)	2 (0.1)	11 (0.05)
Redside shiner	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.1)	5 (0.2)	1 (0.05)	2 (0.07)	1 (0.04)	11 (0.05)
Rainbow trout	0 (0.0)	1 (0.05)	0 (0.0)	2 (0.1)	2 (0.1)	0 (0.0)	1 (0.03)	0 (0.0)	6 (0.03)
Sculpin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.04)	0 (0.0)	1 (0.03)	4 (0.2)	6 (0.03)
Brook trout	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.04)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.01)
Bull trout	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.03)	0 (0.0)	1 (0.01)
TOTAL	1398	2170	4484	2218	2465	2027	2976	2192	19,931

2271 (27.1%) were 4+, 2294 (27.3%) were 5+, 823 (9.8%) were 6+, 9 (0.1%) were 7+, and 8 (0.9%) were 8+. The 860 mountain whitefish caught consisted of 118 (13.7%) 0+, 67 (7.8%) 1+, 204 (23.7%) 2+, 362 (42.1%) 3+, 85 (9.9%) 4+, 4 (0.5%) 5+, 4 (0.5%) 6+, 8 (0.9%) 7+, and 8 (0.9%) 8+. Of the 262 black crappie captured 3 (1 .1%) were 0+, 2 (0.8%) were 1 +, 84 (32.1 %) were 2+, 79 (30.2%) were 3+, 63 (24.0%) were 4+, 16 (6.1%) were 5+, 9 (3.4%) were 6+, and 6 (2.3%) were 7+. The 114 brown trout caught consisted of 4 (3.5%) 0+, 13 (11.4%) 1+, 18 (15.8%) 2+, 11 (9.6%) 3+, 13 (11.4%) 4+, 12 (10.5%) 5+, 12 (10.5%) 6+, and 31 (27.2%) 7+. Of the 11 cutthroat trout caught 0 (0.0%) were 0+, 0 (0.0%) were 1+, 0 (0.0%) were 2+, 2 (18.2%) were 3+, 8 (72.7%) were 4+, and 1 (9.1%) was 5+. Six rainbow trout were captured and 0 (0.0%) were 0+, 1 (16.7%) was 1+, 2 (33.3%) were 2+, 1 (16.7%) was 3+, 1 (16.7%) was 4+, 0 (0.0%) were 5+, and 1 (16.7%) was 6+.

Of the 3791 pumpkinseeds captured 95 (2.5%) were 0+, 130 (3.4%) were 1 +, 451 (11.9%) were 2+, 1119 (29.5%) were 3+, 893 (23.6%) were 4+, 572 (15.1 %) were 5+, and 531 (14.0%) were 6+. The 1920 tench caught consisted of 47 (2.4%) 0+, 75 (3.9%) 1+, 88 (4.6%) 2+, 238 (12.4%) 3+, 224 (11.7%) 4+, 209 (10.8%) 5+, 292 (15.2%) 6+, 690 (35.9%) 7+, 38 (2.0%) 8+, and 19 (1 .O%) 9+. Of the 1057 northern squawfish captured 2 (0.2%) were 0+, 34 (3.2%) were 1+, 400 (37.8%) were 2+, 385 (36.4%) were 3+, 173 (16.4%) were 4+, 30 (2.8%) were 5+, 15 (1.4%) were 6+, 10 (0.9%) were 7+, 1 (0.1%) was 8+, 4 (0.4%).were 9+, and 3 (0.3%) were 10+. The 949 largescale suckers consisted of 29 (3.1%) 0+, 26 (2.7%) 1+, 47 (5.0%) 2+, 45 (4.7%) 3+, 23 (2.4%) 4+, 66 (7.0%) 5+, 218 (23.0%) 6+, 180 (19.0%) 7+, 181 (19.1%) 8+, 112 (11.8%) 9+, and 22 (2.3%) 1 O+. Of the 723 longnose suckers captured 3 (0.4%) were 0+, 8 (1 .1%) were 1+, 53 (7.3%) were 2+, 76 (10.5%) were 3+, 201 (27.8%) were 4+, 293 (40.5%) were 5+, 74 (10.2%) were 6+, 13 (1.8%) were 7+, and 2 (0.3%) were 8+. The 127 peamouth captured consisted of 6 (4.7%) 0+, 27 (21.2%) 1+, 14 (11.0%) 2+, 29 (22.8%) 3+, and 51 (40.2%) 4+. The monthly data on the number of each age class of each species caught can be found in Appendix B, Tables B.9 through B.22.

Gill netting resulted in the capture of 264 fish in 393 hours of gill net sets (Table 3.5). Northern squawfish were the most common species in the nets with 72 (27.3%) followed by peamouth with 51 (19.3%), pumpkinseed with 48 (18.2), and largescale sucker with 27 (10.2%). Other species found in the nets included longnose sucker (6.8%), yellow perch (14.0%), tench (5.3%), mountain whitefish

Table 3.4. **Total number and relative abundance (%) of each age class of each species caught during relative abundance electrofishing surveys on the Pend Oreille River, WA from March through October, 1988.**

AGE	LMB	YP	MWF	BC	BRNT	CTT	RBT	PS	TEN	SQF	LSS	LNS	PM
0+	140 (9.8)	68 (0.8)	118 (13.7)	3 (1.1)	4 (3.5)	0 (0.0)	0 (0.0)	95 (2.5)	47 (2.4)	2 (0.2)	29 (3.1)	3 (0.4)	6 (4.7)
1+	233 (16.2)	137 (1.6)	67 (7.8)	2 (0.8)	13 (11.4)	0 (0.0)	1 (16.7)	130 (3.4)	75 (3.9)	34 (3.2)	26 (2.7)	8 (1.1)	27 (21.2)
2+	421 (29.4)	769 (9.2)	204 (23.7)	84 (32.1)	18 (15.8)	0 (0.0)	2 (33.3)	451 (11.9)	88 (4.6)	400 (37.8)	47 (5.0)	53 (7.3)	14 (11.0)
3+	285 (19.9)	2019 (24.1)	362 (42.1)	79 (30.2)	11 (9.6)	2 (18.2)	1 (16.7)	1119 (29.5)	238 (12.4)	385 (36.4)	45 (4.7)	76 (10.5)	29 (22.8)
4+	57 (4.0)	2271 (27.1)	85 (9.9)	63 (24.0)	13 (11.4)	8 (72.7)	1 (16.7)	893 (23.6)	224 (11.7)	173 (16.4)	23 (2.4)	201 (27.8)	51 (40.2)
5+	61 (4.2)	2294 (27.3)	4 (0.5)	16 (6.1)	12 (10.5)	1 (9.1)	0 (0.0)	572 (15.1)	209 (10.8)	30 (2.8)	66 (7.0)	293 (40.5)	
6+	78 (5.4)	823 (9.8)	4 (0.5)	9 (3.4)	12 (10.5)		1 (16.7)	531 (14.0)	292 (15.2)	15 (1.4)	218 (23.0)	74 (10.2)	
7+	69 (4.8)	9 (0.1)	8 (0.9)	6 (2.3)	31 (27.2)				690 (35.9)	10 (0.9)	180 (19.0)	13 (1.8)	
8+	21 (1.5)	8 (0.9)	8 (0.9)						38 (2.0)	1 (0.1)	181 (19.1)	2 (0.3)	
9+	19 (1.3)								19 (1.0)	4 (0.4)	112 (11.8)		
10+	7 (0.5)									3 (0.3)	22 (2.3)		
11+	28 (2.0)												
12+	0 (0.0)												
13+	1 (0.1)												
14+	14 (1.0)												

LMB = Largemouth bass
YP = Yellow perch
MWF = Mountain whitefish
Bc = Black crappie
BRNT = Brown trout
CCT = Cutthroat trout
RBT = Rainbow trout
PS = Pumpkinseed
E N = Tench
SQF = Northern squawfish
LSS = Largescale sucker
LNS = Longnose sucker
FM = Peamouth

(4.5%), brown trout (1.9%) brown bullhead (0.8%), and cutthroat trout (0.4%). The breakdown of the catch by age class can be found in Appendix B, Table 8.23. The number of fish caught in each study site for each month can be found in Appendix B, Table B.24 through 8.31.

In beach seining 6261 m^2 (1361 m of slough times 4.6 m width of seine while being pulled) of sloughs from July through October, 1988, a total of 3407 fish were collected (Table 3.6). Pumpkinseed made up 87.5 percent of the catch followed by largemouth bass at 9.6 percent. Other species captured while beach seining included yellow perch (2.3%), tench (0.4%), black crappie (0.1%), and brown bullhead (0.03%).

Of the 2,982 pumpkinseeds captured by beach seining, 2730 (91.5%) were young-of-the-year (YOY) (Table 3.7). The 327 largemouth bass captured consisted of 290 (88.7%) YOY. Eighty yellow perch were captured by beach seine with 58 (72.5%) being YOY fish. The number of fish caught by beach seine at each study site during July through October, 1988, can be found in Appendix B, Tables 8.32 through 8.35.

Results of selective netting surveys can be found in Appendix B, Tables 8.36 through B.39.

3.2 POPULATION ESTIMATES

3.2.1 TRIBUTARIES

3.2.1 .1 SKOOKUM CREEK

A Total of 80 brown trout, 109 brook trout, and one cutthroat trout were marked on May 9, 1988 (Table 3.8). During the recapture trip on May 12, 1988, 79 brown trout, 91 brook trout, and 2 cutthroat trout were caught. Of the trout caught during the recapture period, 14 brown trout, 17 brook trout, and 1 cutthroat trout were marked.

The population estimate for brown trout in Skookum Creek for the 800 yards sampled was 451±195 (Table 3.9). Expanded for the entire 17.1 km stream, the population estimate was 10,543±4,551 brown trout. The population estimate for brook trout was 583±230 for 800 yards of stream and 13,628±5,369 for the entire stream.

Table 3.5. Number and percent of each species caught in gill nets during March-October, 1988.

	March	April	May	June	July	August	September	October	Annual
Soak time (hrs)	42.3	77.0	24.0	44.3	73.3	54.4	55.3	22.2	392.8
Northern squawfish	4 (17.4)	7 (23.3)	2 (33.3)	6 (15.4)	27 (32.1)	16 (30.2)	9 (34.6)	1 (33.3)	72 (27.3)
Peamouth	7 (30.4)	2 (6.7)	3 (50.0)	8 (20.5)	15 (17.9)	9 (17.0)	7 (26.9)	0 (0.0)	51 (19.3)
Pumpkinseed	1 (4.3)	8 (26.7)	0 (0.0)	6 (15.4)	25 (29.8)	6 (11.3)	2 (7.7)	0 (0.0)	48 (18.2)
Largescale sucker	2 (8.7)	2 (6.7)	0 (0.0)	3 (7.7)	1 (1.2)	11 (20.8)	6 (23.1)	2 (66.7)	27 (10.2)
Longnose sucker	7 (30.4)	4 (13.3)	0 (0.0)	2 (5.1)	1 (1.2)	3 (5.7)	1 (3.8)	0 (0.0)	18 (6.8)
Yellow perch	0 (0.0)	5 (16.7)	0 (0.0)	9 (23.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	14 (5.3)
Tench	0 (0.0)	2 (6.7)	0 (0.0)	2 (5.1)	6 (7.1)	4 (7.5)	0 (0.0)	0 (0.0)	14 (5.3)
Mountain whitefish	0 (0.0)	0 (0.0)	0 (0.0)	3 (7.7)	8 (9.5)	0 (0.0)	1 (3.8)	0 (0.0)	12 (4.5)
Brown trout	1 (4.3)	0 (0.0)	1 (16.7)	0 (0.0)	1 (1.2)	2 (3.8)	0 (0.0)	0 (0.0)	5 (1.9)
Brown bullhead	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (3.8)	0 (0.0)	0 (0.0)	2 (0.8)
Cutthroat trout	1 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.4)
Total	23	30	6	39	84	53	26	3	264

Table 3.6. Number and percent of each species of fish caught by beach seining during July through October, 1988.

	July	August	September	October	Total
Distance seined (m)	274	320	503	264	1361
Pumpkinseed	309 (58.2)	1007 (90.2)	1646 (95.1)	20 (69.0)	2982 (87.5)
Largemouth bass	169 (31.8)	89 (8.0)	63 (3.6)	6 (20.7)	327 (9.6)
Yellow perch	47 (8.8)	17 (1.5)	13 (0.8)	3 (10.3)	80 (2.3)
Tench	4 (0.8)	4 (0.4)	7 (0.4)	0 (0.0)	15 (0.4)
Black crappie	1 (0.2)	0 (0.0)	1 (0.1)	0 (0.0)	2 (0.1)
Brown bullhead	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.03)
Total	531	1117	1730	29	3407

Table 3.7. Total number and percent of each age class of each species of fish collected during beach seine surveys in sloughs along the Pend Oreille River, WA (July-October, 1988).

	July	August	September	October	Total
Distance seined (m)	274	320	503	264	1361
Pumpkinseed 0 +	136 (44.0)	970 (96.3)	1611 (97.9)	13 (65.0)	2730 (91.5)
1 +	27 (8.7)	16 (1.6)	3 (0.2)	0 (0.0)	46 (1.5)
2 +	18 (5.8)	6 (0.6)	1 (0.1)	0 (0.0)	25 (0.8)
3 +	27 (8.7)	9 (0.9)	11 (0.7)	0 (0.0)	47 (1.6)
4 +	55 (17.8)	5 (0.5)	13 (0.8)	3 (15.0)	76 (2.5)
5 +	30 (9.7)	1 (0.1)	4 (0.2)	3 (15.0)	38 (1.3)
6 +	16 (5.2)	0 (0.0)	3 (0.2)	1 (5.0)	20 (0.7)
Total	309	1007	1646	20	2982
Largemouth bass 0 +	158(93.5)	87 (97.8)	43 (68.3)	2 (33.3)	290 (88.7)
1 +	7 (4.1)	1 (1.1)	18 (28.6)	3 (50.0)	29 (8.9)
2 +	4 (2.4)	1 (1.1)	0 (0.0)	1 (16.7)	6 (1.8)
3 +	0 (0.0)	0 (0.0)	2 (3.2)	0 (0.0)	2 (0.6)
Total	169	89	63	6	327
Yellow perch 0 +	36 (76.7)	16 (94.1)	6 (46.2)	0 (0.0)	58 (72.5)
1 +	2 (4.2)	0 (0.0)	1 (7.7)	0 (0.0)	3 (3.8)
2 +	3 (6.4)	0 (0.0)	0 (0.0)	0 (0.0)	3 (3.8)
3 +	6 (12.8)	1 (5.9)	2 (15.4)	0 (0.0)	9 (11.2)
4 +	0 (0.0)	0 (0.0)	4 (30.8)	0 (0.0)	4 (5.0)
5 +	0 (0.0)	0 (0.0)	0 (0.0)	2 (66.6)	2 (2.5)
6 +	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	1 (1.2)
Total	47	17	13	3	80
Tench 0 +	4 (100.0)	4 (100.0)	7 (100.0)	0 (0.0)	15 (100.0)
Total	4	4	7	0	15
Black crappie 0 +	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (50.0)
1 +	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (50.0)
Total	1	0	1	0	2
Brown bullhead 1 +	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)
Total	1	0	0	0	1

Table 3.8. Number of each species of trout marked (m) in the initial capture period, the total number caught in the subsequent recapture (C), and the number of marked fish caught in the recapture (r) for each reach of Skookum Creek on May 9 and 12, 1988.

Study reach	Reach length (yd)	Number marked in capture (m)	Number caught in recapture (C)	Number of marked recaptured (r)	Conductivity (µmhos/cm)
Brown Trout					
1	200	54	48	10	139
2	200	22	28	4	147
3	200	4	3	0	137
4	200	0	0	0	- - -
Total	800	80	79	14	
Brook Trout					
1	200	7	6	2	139
2	200	14	6	1	147
3	200	10	17	3	137
4	200	72	57	9	- - -
Total	800	109	91	17	
Cutthroat Trout					
1	200	0	0	0	139
2	200	0	0	0	147
3	200	1	1	1	137
4	200	0	1	0	- - -
Total	800	1	2	1	

Cutthroat trout were estimated at 2±1 for 800 yards and 47±23 for the stream.

Table 3.10 shows the number and percent caught in Skookum Creek by age for brown and brook trout. About 66 percent of the brown trout caught in the mark and recapture period were 1+ fish, 19 percent were 2+, 11 percent were 3+, and 4 percent were 4+. Seventy-six percent of the brook trout were 1+, 23 percent were 2+, and 1 .1 percent were 3+.

3.2.1.2 CEE CEE AH CREEK

One hundred and eight brown trout, 132 brook trout, and 10 cutthroat trout were marked in Cee Cee Ah Creek during fish marking on May 11, 1988 (Table 3.11). On May 13, 1988, 129 brown trout, 88 brook trout and 17 cutthroat trout were caught with 26, 27, and 4, respectively, having marks.

The population estimate for brown trout was 536±161 for the 800 yards sampled (Table 3.12). The population for the entire 15.5 km of Cee Cee Ah Creek, for brown trout was 11,357±3,411. The brook trout population was estimated at 430±121 for 800 yards and 9,11 1±2,564 for the stream. Cutthroat trout were estimated at 42±28 for 800 yards and 890±593 for the stream.

Of the brown trout caught during mark and recapture periods, 80 percent were 1+, 10 percent were 2+, 7 percent were 3+, and 3 percent were 4+ (Table 3.13). Brook trout were 85 percent 1+, 14 percent 2+, and 1 percent 3+. Cutthroat trout were found to be 74 percent 1+ and 26 percent 2+.

3.2.1.3 TACOMA CREEK

During fish marking on May 11, 1988, 8 brown trout, 81 brook trout and 6 cutthroat trout were marked in Tacoma Creek (Table 3.14). During recapture on May 13, 1988, 1 brown trout, 124 brook trout, and 15 cutthroat trout were caught. None of the brown trout, 5 of the brook trout and 1 of the cutthroat had previously been marked.

The population estimate for brook trout in Tacoma Creek was 2,009±1,672 for 800 yards and 90,903±75,655 for the entire 33.1 km of the stream (Table 3.15). Cutthroat trout were estimated at 90±1 56 for 800 yards and 4,072±7,059 for the stream.

Table 3.9. Trout population (±C.I.) for Skookum Creek. Trout populations were estimated for the 800 yards sampled and then expanded for the entire 17.1 km length of the stream.

Species	Population (±C.I.)/ 800 yards	Population (±C.I.)/ 17.1 km stream
Brown Trout	451k194.7	10,543±4,551
Brook Trout	583±229.7	13,628±5,369
Cutthroat Trout	2±1	47±23

Table 3.10. Age distribution of trout collected during population estimation in Skookum Creek. Age/length relationship was determined by back-calculation of the length at annulus formation (see section 3.3).

Brown Trout				
Age	1+	2+	3+	4+
Size range	≤132	133-I 92	193-264	≥265
Number caught	**96**	**27**	**16**	**6**
Percent caught	**66.2**	**18.6**	11 .o	**4.1**
Brook Trout				
Size range	≤128	129-199	≥200	
Number caught	**139**	**42**	**2**	
Percent caught	**76.0**	**23.0**	**1.1**	

Table 3.11. Number of each species of trout marked (m) in the initial capture period, the total number caught in the subsequent recapture (C), and the number of marked fish caught in the recapture (r) for each reach of Cee Cee Ah Creek on May 11 and 13, 1988.

Study reach	Reach length (yd)	Number marked in capture (m)	Number caught in recapture (C)	Number of marked recaptured (r)	Conductivity (µmhos/cm)
Brown Trout					
1	200	41	42	6	32
2	200	62	84	19	42
3	200	5	3	1	21
4	200	0	0	0	12
Total	800	108	129	26	
Brook Trout					
1	200	1	1	0	32
2	200	0	0	0	42
3	200	19	22	6	21
4	200	112	65	21	12
Total	800	132	88	27	
Cutthroat Trout					
1	200	0	0	0	32
2	200	0	0	0	42
3	200	10	17	4	21
4	200	0	0	0	12
Total	800	10	17	4	

Table 3.12. Trout population (±C.I.) for Cee Cee Ah Creek. Trout populations were estimated for the 800 yards sampled and then expanded for the entire 15.5 km length of the stream.

Species	(Population (±C.I.)/ 800 yards	Population (±C.I.)/ 15.5 km stream
Brown Trout	536±161	11,357±3,411
Brook Trout	430±121	9.111 ±2.564
Cutthroat Trout	42±28	890±593

Table 3.13. Age distribution of trout collected during population estimation in Cee Cee Ah Creek. Age/length relationship was determined by back-calculation of the length at annulus formation (see section 3.3).

Brown Trout				
Age	1+	2+	3+	4+
Size range	≤135	136-I 98	199-251	≥252
Number caught	169	21	14	7
Percent caught	80.1	10.0	6.6	3.3
Brook Trout				
Size range	≤134	135-195	≥196	
Number caught	164	27	2	
Percent caught	85.0	14.0	1 .0	
Cutthroat Trout				
Size range	≤135	≥136		
Number caught	17	6		
Percent caught	73.9	26.1		

Table 3.14. Number of each species of trout marked (m) in the initial capture period, the total number caught in the subsequent recapture (C), and the number of marked fish caught in the recapture (r) for each reach of Tacoma Creek on May 11 and 13, 1988.

Study reach	Reach length (yd)	Number marked in capture (m)	Number caught in recapture (C)	Number of marked recaptured (r)	Conductivity (µmhos/cm)
Brown Trout					
1	200	8	1	0	19
2	200	0	0	0	20
3	200	0	0	0	21
4	200	0	0	0	19
Total	800	8	1	0	
Brook Trout					
1	200	3	4	0	19
2	200	27	38	3	20
3	200	24	37	0	21
4	200	27	45	2	19
Total	800	81	124	5	
Cutthroat Trout					
1	200	0	1	0	19
2	200	5	9	1	20
3	200	0	0	0	21
4	200	1	5	0	19
Total	800	6	15	1	

Sixty-seven percent of the brown trout caught were 1+, 11 percent were 2+, and 22 percent were 4+ (Table 3.16). Of the brook trout caught, 61 percent were 1+ and 39 percent were 2+. Cutthroat trout were 90 percent 1+, 5 percent 2+, and 5 percent 3+.

3.2.1.4 LECLERC CREEK

On May 10, 1988, 24 brown trout, 24 brook trout, and 2 cutthroat trout were caught on the first electrofishing pass (Table 3.17). The second pass resulted in the capture of 7 brown trout, 4 brook trout, and 0 cutthroat trout.

The population estimate for brown trout was 34±6 for 800 yards and 1,222±216 for the entire 26.3 km of the West Branch of LeClerc Creek (Table 3.18). The brook trout population was estimated to be 29±2 and 1,043±72 for 800 yards and the entire stream respectively. Cutthroat trout were estimated at 2±0 for 800 yards and 72±0 for the stream.

Of the brown trout captured, about 61 percent were 1+, 15 percent 2+, 9 percent 3+, and 15.1 percent 4+ (Table 3.19). Sixty-seven percent of the brook trout were 1+, 30 percent 2+, and 3 percent 3+.

3.2.1.5 RUBY CREEK

Twenty-six brook trout were caught in the first pass and 12 in the second pass of reach 1, yielding a population estimate (±C.I.) of 48±19 for the 49 m reach (Table 3.20). In reach 2, 65 brook trout were caught in the first pass and 25 in the second. This gave a population estimate (±C.I.) of 106±19 for the 61 m reach. Seven cutthroat trout were caught in the first pass of reach 1 and none were captured in the second pass. This results in a population estimate of 7±0. One cutthroat was captured in each of the two passes in reach 2, so the population was known to be greater than or equal to 2.

Table 3.21 shows the expanded population estimate for brook trout and cutthroat trout. Each reach was normalized to represent the population per 100 m, added together and expanded to represent the population (±C.I.) for the 18.8 km of the stream. This process gave an estimated population of 25,568±6,486 brook trout and 1,598 cutthroat trout for the stream.

Table 3.15. Trout population (±C.I.) for Tacoma Creek. Trout populations were estimated for the 800 yards sampled and then expanded for the entire 33.1 km length of the stream.

Species	Population (±C.I.)/ 800 yards	Population (±C.I.)/ 33.1 km stream
Brown Trout	- - -	- - -
Brook Trout	2,009±1,672	90,903±75,655
Cutthroat Trout	90±156	4.072±7.059

Table 3.16. Age distribution of trout collected during population estimation in Skookum Creek. Age/length relationship was determined by back-calculation of the length at annulus formation (see section 3.3).

Brown Trout			
Age	1+	2+	3+
Size range	≤164	165-211	≥212
Number caught	6	1	2
Percent caught	66.7	11.1	22.2
Brook Trout			
Size range	≤122	123-198	≥198
Number caught	122	78	
Percent caught	61.0	39.0	
Cutthroat Trout			
Size range	≤170	171-233	≥234
Number caught	18	1	1
Percent cauaht	90.0	5.0	5.0

Table 3.17. Number of each species of trout caught in the first and second passes while conducting a removal-depletion population estimate for the West Branch of LeClerc Creek on May 10, 1988.

Study reach	Reach length (yd)	Number caught in first pass	Number caught in second pass	Conductivity (μmhos/cm)
Brown Trout				
1	200	7	0	34
2	200	3	3	33
3	200	14	4	37
4	200	0	0	19
Total	800	24	7	
Brook Trout				
1	200	5	0	34
2	200	6	3	33
3	200	9	0	37
4	200	4	1	19
Total	800	24	4	
Cutthroat trout				
1	200	0	0	34
2	200	0	0	33
3	200	2	0	37
4	200	0	0	19
Total	800	2	0	

Table 3.18. Trout population (±C.I.) for the West Branch of LeClerc Creek. Trout populations were estimated for the 800 yards sampled and then expanded for the entire 26.3 km of the west branch of LeClerc Creek.

Species	Population (±C.I.)/800 yards	Population (±C.I.)/26.3 km
Brown trout	34±6	1,222±216
Brook trout	29±2	1,043±72
Cutthroat trout	2±0	72±0

Table 3.19. Age distribution of trout collected during population estimation in LeClerc Creek. Age/length relationship was determined by back-calculation of the length at annulus formation (see section 3.3).

Brown Trout				
Age	1+	2+	3+	4+
Size range	≤141	142-206	207-271	≥272
Number caught	20	5	3	5
Percent caught	60.6	15.2	9.1	15.2
Brook Trout				
Size range	≤121	122-188	≥189	
Number caught	22	10	1	
Percent caught	66.7	30.3	3.0	

Table 3.20. Number of each species of trout caught in the first and second passes while conducting a removal-depletion population estimate for Ruby Creek on July 12, 1988. Population estimates (±C.I.) are found in the far right column.

Study reach	Reach length (m)	Number caught in first pass	Number caught in second pass	Population Est. (±C.I.)
Brook trout				
1	49	26	12	48±19
2	61	65	25	106±19
Cutthroat trout				
1	49	7	0	7±0
2	61	1	1	≥2

Table 3.21. Expanded brook trout population (±C.I.) for Ruby Creek.

Reach 1		Reach 2		Combined	Expanded
Population (±C.I.)/49m	Population (±C.I.)/100m	Population (±C.I.)/61m	Population (±C.I.)100m	Population (±C.I.)/200m	Population (±C.I.)/18.8km
Brook trout					
48±19	98±38	106±19	174±31	272±69	25,568±6,486
Cutthroat trout					
7±0	14±0	2	3	17	1,598

Forty-six percent of the brook trout caught during population estimation were 0+, followed by 37 percent 1+, and 17 percent 2+ (Table 3.22). Cutthroat trout were 56 percent 1+ and 44 percent 2+.

3.2.2 RIVER AND SLOUGHS

The estimated populations for one year and older fish in the river between Albeni Falls and Box Canyon Dams can be found in Table 3.23. A total of 8,377 one year and older yellow perch were captured, 6,266 were released with marks, and 12 were recaptured (Appendix C, Table C.l). The estimated population for yellow perch was 41,777,446 with a lower 95 percent confidence limit of 23,872,826 and an upper limit of 80,859,573. A total of 4,017 one year and older pumpkinseeds were captured, 2,590 were marked, and 6 were recaptured (Appendix C, Table C.2). The pumpkinseed population estimate was 16,822,372 with a lower 95 percent confidence limit of 7,704,903 and an upper limit of 45,879,196. A total of 1902 one year and older tench were captured, 1634 were marked, and 7 were recaptured (Appendix C, Table C.3). The tench population was estimated at 4,282,807 with the lower 95 percent confidence limit at 2,081,920 and the upper limit at 10,707,019. A total of 950 one year and older largescale suckers were captured, 785 were marked, and 9 were recaptured (Appendix C, Table C.4). The population estimate for largescale sucker was 821,863 with the lower and upper 95 percent confidence limits at 432,560 and 1,849,192, respectively.

A total of 749 one year and older longnose suckers were caught 620 were marked and 6 were subsequently recaptured (Appendix C, Table C.5). The estimated population of longnose sucker was 781,166 with a lower 95 percent confidence limit of 357,786 and an upper limit of 2,130,452. A total of 1,749 one year and older largemouth bass were caught, 944 marked, and 28 recaptured (Appendix C, Table C.6). The largemouth bass population was estimated at 657,549 with the lower 95 percent confidence limit at 455,727 and the upper limit at 989,859. A total of 1,130 one year and older northern squawfish were captured, 766 were marked, and 16 were recaptured (Appendix C, Table C.7). The population estimate for northern squawfish was 580,565 with a lower 95 percent confidence limit of 357,271 and an upper confidence limit of 1,009,679. A total of 299 one year old and older black crappie were captured, 196 were marked, and 1 was recaptured (Appendix C, Table C.8). The estimated population for black crappie was 579,588 with

Table 3.22. Age distribution of trout collected during population estimation in Ruby Creek. Age/length relationship was determined by back-calculation of the length at annulus formation (see section 3.3).

Brook Trout			
Age	0+	1+	2+
Size range	≤88	89-147	≥147
Number caught	59	47	22
Percent caught	46.1	36.7	17.2
Cutthroat trout			
Size range	≤97	98-157	≥158
Number caught	0	5	4
Percent caught	0	55.6	44.4

the lower 95 percent confidence limit at 103,498 and the upper limit at 5,795,881. A total of 989 one year and older mountain whitefish were captured, 643 were marked, and 39 were recaptured (Appendix C, Table C.9). The mountain whitefish population was estimated at 164,252 with a lower 95 percent confidence limit of 120,185 with the upper limit of 231,258.

Population estimates for specific locations are listed in Table 3.24. A total of 149 one year and older largemouth bass were caught in May and June in at site 1B (Appendix C, Table C.10). Eighty-one were marked and 9 were recaptured. The largemouth bass population was estimated at 695 with the lower 95 percent population estimate at 366 and the upper limit at 1565. A Petersen estimate was conducted at site 4A on May 21 and 22, 1988 for largemouth bass. Twenty-nine largemouth bass were marked and 47 were captured during the recapture period with 3 having marks. This yielded a population estimate of 454±471. A total of 169 brown trout one year and older were captured, 111 were marked, and 42 recaptured at study site 3A during sampling in March through October, 1988 (Appendix C, Table C.ll). The brown trout population was estimated at 229 with the lower 95 percent confidence limit at 169 and the upper limit at 317.

The number of brown trout recaptures at site 3A made it possible to estimate the population of 4, 5, 6, and 7 year old fish (Table 3.24). A total of 25, 4+ brown trout were captured, 18 were marked, and 4 were recaptured (Appendix C, Table C.12). The population of 4+ brown trout in 3A was 49 with a lower 95 percent confidence limit of 19 and an upper limit of 196. A total of 38, 5+ brown trout were captured, 21 marked, and 14 recaptured (Appendix C, Table C.13). The population of 5+ brown trout in 3A was 29 with the lower 95 percent confidence limit at 17 and the upper limit at 53. Thirty-six 6+ brown trout were captured at site 3A, 25 were marked, and 7 were recaptured (Appendix C, Table C.14). The population estimate for 6+ brown trout in 3A was 65 with the lower 95 percent confidence limit at 32 and the upper limit at 164. Sixty-three 7+ brown trout were captured in 3A, 41 were marked, and 17 were recaptured (Appendix C, Table C.15). The estimated population for 7+ brown trout in 3A was 78 with a lower 95 percent confidence limit of 49 and an upper limit of 133.

A total of 15 one year and older brown trout were captured at site 2, 8 were marked, and 2 were recaptured (Appendix C, Table

Table 3.23. Population estimates and 95 percent confidence limits for one year and older fish in the Pend Oreille River between Albeni Falls and Box Canyon Dams.

	ESTIMATED POPULATION	95 PERCENT CONFIDENCE LIMITS LOWER LIMIT	UPPER LIMIT
Yellow perch	41,777,446	23,872,826	80,859,573
Pumpkinseed	16,822,372	7,704,903	45,879,573
Tench	4,282,807	2,081,920	10,707,019
Largescale sucker	821,863	432,560	1,849,192
Longnose sucker	781,166	357,786	2,130,452
Largemouth bass	657,549	455,727	989,859
Northern squawfish	580,565	357,271	1,009,679
Black crappie	579,588	103,498	5,795,881
Mountain whitefish	164,252	120,185	231,258

Table 3.24. Population estimates and 95 percent confidence limits for one year and older fish at specific areas of the Pend Oreille River.

	LOCATION	EST. POP.	95 PERCENT CONFIDE- LOWER LIMIT	UPPER LIMIT
Largemouth bass	1B	695	366	1565
Largemouth bass	4A	454	0	925
Brown trout (all ages)	3A	229	169	317
Brown trout (4+)	3A	49	19	196
Brown trout (5+)	3A	29	17	53
Brown trout (6+)	3A	65	32	164
Brown trout (7+)	3A	78	49	133
Brown trout	2	30	8	295
Brown trout	8A	85	45	270
Mountain whitefish	3A	512	355	770
Mountain whitefish	2	4,003	2,027	9,420
Mountain whitefish	8A	154	86	314

C.16). This yielded a population estimate of 30 with the lower 95 percent confidence limit at 8 and the upper limit at 295 (Table 3.24). Forty-five one year and older brown trout were captured at site 8A, 20 were marked, and 7 were recaptured (Appendix C, Table C.17). The estimated population was 85 with the lower 95 percent confidence limit at 45 and the upper limit at 270. A total of 224 one year and older mountain whitefish were captured at site 3A, 149 were marked, and 28 were recaptured (Appendix C, Table C.18). The estimated population was 512 with the lower 95 percent confidence limit at 355 and the upper limit at 770. A total of 308 mountain whitefish were captured, 214 marked, and 8 recaptured at study site 2 (Appendix C, Table C.19). This yielded an estimated population of 4,003 with the lower 95 percent confidence limit at 2,027 and the upper limit at 9,420. Eighty-two mountain whitefish were captured at site 8A, 42 were marked, and 11 were recaptured (Appendix C, Table C.20). The estimated population was 154 with the lower 95 percent confidence limit at 86 and the upper limit at 314.

3.3 AGE, GROWTH, AND CONDITION

3.3.1 TRIBUTARIES

3.3.1.1 BROWN TROUT

Scales were collected from 68 brown trout in Skookum Creek for age determinations and the back calculation of growth. Brown trout cohorts in Skookum Creek ranged in mean length from 76 mm to 111 mm for the first year of growth with the grand mean at 80 mm (Table 3.25). Mean length at the formation of the second annulus ranged from 131 to 153 mm with a grand mean of 132 mm. The mean length at the end of the third year of growth ranged from 190 to 215 mm with the grand mean at 192 mm. The back-calculated length at the end of the fourth year of growth was 264 mm for the only 4 year old brown trout in the sample.

Scales were collected from 122 brown trout in Cee Cee Ah Creek for age determination and back-calculations of growth. Mean lengths at the first annulus ranged from 78 to 86 mm for the four cohorts of brown trout in Cee Cee Ah Creek, with the grand mean at 81 mm (Table 3.26). Mean lengths after the second year of growth ranged from 131 to 142 mm with a grand mean of 135 mm. At the end of the third year of growth the mean length ranged from 194 to 198 mm with the grand at 198 mm. The mean length at the formation of the fourth annulus was 251 mm.

Table 3.25. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brown trout in Skookum Creek

COHORT	N	MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS 1	2	3	4
1987	26	79±12.9			
1986	26	81±14.8	131±21.3		
1985	15	76±12.1	132±21.1	190±32.3	
1984	1	111	153	215	264
GRAND MEAN		N=68 80±13.9	N=42 132±21.3	N=16 192±31.8	N=1 264
MEAN ANNUAL GROWTH INCREMENT		80	52	60	72

Table 3.26. Mean back-calculated lenghts at the end of each years growth (annulus formation) for each year class of brown trout in Cee Cee Ah Creek.

COHORT	N	MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS 1	2	3	4
1987	33	78±17.5			
1986	53	79±23.8	131±33.7		
1985	31	86±18.2	139±25.8	198±35.9	
1984	5	83±11.3	142±17.2	194±17.1	251±13.2
GRAND MEAN		N=122 81±20.5	N=89 135±30.5	N=36 198±33.8	N=5 251±13.2
MEAN ANNUAL GROWTH INCREMENT		81	54	63	53

Six **scale** samples were calculated from brown trout in Tacoma Creek for **age** determination and the back-calculation of growth (Table 3.27). Mean lengths after the first **year** of growth ranged from 87 to 106 mm with a grand mean of 93 mm. Mean length at the second **annulus** was 164 mm and 212 mm was the mean length at the end of the third year of growth.

Scale samples were collected from 45 brown trout in LeClerc Creek for age determination and the back-calculation of growth. Mean lengths, for the four cohorts of brown trout, after the first year of growth ranged from 77 to 82 mm with a grand mean of 78 mm (Table 3.28). Mean lengths after the second **year** ranged from 141 to 142 mm with a grand mean of 141 mm. After the third year of growth, lengths averaged from 199 to 213 mm with the overall mean at 206 mm. Mean length after the fourth year of growth was 271 mm.

Table 3.29 shows the mean weights, lengths, and condition factors for each age class of brown trout in Skookum Creek, Cee Cee Ah Creek, and LeClerc Creek. Condition factors in Skookum Creek ranged from 0.87 to 1.13 with a overall mean of 0.92. Cee Cee Ah brown trout condition factors ranged from 0.90 to 1 **.13** with the **overall mean at** 1 .OO. LeClerc Creek brown trout condition factors ranged from 0.99 to 1.17 with a grand mean of 1.05.

3.3.1.2 BROOK TROUT

Scales were collected from 111 brook trout in Skookum Creek for age determination and back-calculation of growth. For the first year, brook trout average growth was 81 to 105 mm and the grand mean was 86 mm for all cohorts (Table 3.30). Mean length at the end of the second year of growth ranged from 125 to 149 mm with an **average of 128 mm.** Mean length at the end of the third year of growth was 199 mm.

Sixty-five scale samples were collected from brook trout in Cee Cee Ah Creek. Mean lengths at the formation of the first **annulus** ranged from 89 to 108 mm and the overall mean was 92 mm (Table 3.31). Brook trout mean lengths ranged from 130 to 160 mm after the second year of growth with the grand mean at 134 mm. The length at the formation of the third **annulus** was 195 mm.

Scale samples were collected from 43 brook trout in LeClerc Creek for age determination and back-calculation of growth. Mean

Table 3.27. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brown trout in Tacoma Creek.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS		
COHORT	N	1	2	3
1987	4	87±11.4		
1986	0			
1985	2	106±8.6	164±5.0	212±26.8
GRAND MEAN		N=6 93±3.6	N=2 164±5.0	N=2 212±26.8
MEAN ANNUAL GROWTH INCREMENT		93	71	48

Table 3.28. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brown trout in LeClerc Creek.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS			
COHORT	N	1	2	3	4
1987	17	77±11.2			
1986	14	77±13.6	141k22.1		
1985	7	81 ±10.7	141 ±25.0	199±42.5	
1984	7	82±12.0	142±22.2	213±23.2	271 ±36.7
GRAND MEAN		N=45 78±11.8	N=28 141±22.0	N=14 206±33.7	N=7 271±36.7
MEAN ANNUAL GROWTH INCREMENT		78	63	65	65

Table 3.29. Mean weights, lengths, and condition factors (K_{TL}) for each age class of brown trout in Skookum, Cee Cee Ah, and LeClerc Creeks.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
Skookum Creek				
0 +	6	3.4±0.9	72.7±6.7	0.87±0.06
1 +	9	10.6±2.8	104.4±10.5	0.91±0.07
2 +	6	33.8±15.5	151.3±20.4	0.93±0.12
3 +	2	165.0±7.1	258.0±0.0	0.96±0.04
4 +	1	304	300	1.13
Total	24			0.92±0.09
Cee Cee Ah				
0+	9	2.2±1.5	60.1f11.9	0.90f0.12
1 +	18	15.4f7.5	112.8f15.5	0.99±0.23
2 +	21	44.2f17.2	163.9f18.2	0.95±0.13
3 +	14	127.5f30.4	223.2f13.7	1.13±0.18
4 +	7	226.0f48.3	281.3k18.8	1.01±0.13
Total	69			1.00±0.18
LeClerc Creek				
0 +	5	3.afl.3	68.2±5.0	1.17±0.15
1 +	9	15.0f4.7	113.2f9.6	0.99±0.17
2 +	8	60.8f18.4	177.6f18.4	1.05f0.07
3 +	3	158.3f28.4	247.3±17.1	1.04±0.09
4 +	6	305.7f73.8	307.7f23.6	1.03f0.05
Total	31			1.05f0.12

Table 3.30. **Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout in Skookum Creek.**

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS		
COHORT	N	1	2	3
1987	59	81±14.2		
1986	45	89±11.7	125±17.2	
1985	7	105±29.4	149±40.0	199±40.9
GRAND MEAN		N=111 86±15.7	N=52 128±22.6	N=7 199±40.9
MEAN ANNUAL GROWTH INCREMENT		86	42	71

Table 3.31. **Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout in Cee Cee Ah Creek.**

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS		
COHORT	N	1	2	3
1987	41	89±12.5		
1986	21	95±9.2	130±12.85	
1985	3	108±10.4	160f20.2	195f21.3
GRAND MEAN		N=65 92±12.2	N=24 134±16.8	N=3 195±21.3
MEAN ANNUAL GROWTH INCREMENT		92	42	61

lengths for all cohorts of LeClerc Creek brook trout at the end of the first years growth, ranged from 83 to 95 mm with the overall mean at 89 mm (Table 3.32). Mean lengths at the end of the second years growth ranged from 116 to 143 mm with a grand mean of 121 mm. The mean length at the end of the second years growth was 188 mm.

A total of 110 scale samples were collected from Tacoma Creek brook trout. Mean lengths at the first annulus formation for all cohorts ranged from 77 to 88 mm with the overall mean at 80 mm (Table 3.33). Mean lengths at the end of the second years growth ranged from 107 to 122 mm with the mean at 122 mm. The length after the third year of the growth was 198 mm for the only three year old fish caught.

Scale samples were collected from 16 brook trout from Ruby Creek. Mean lengths at the first annulus formation ranged from 86 to 94 mm with a mean of 88 mm (Table 3.34). Mean length at the end of the second years growth was 147 mm.

Mean condition factors for Skookum Creek brook trout ranged from 0.99 to 1.25 with a overall mean of 1.07 (Table 3.35). Cee Cee Ah brook trout condition factors ranged from 0.93 to 1 .14 with a grand mean of 0.95. Mean condition factors in LeClerc Creek ranged from 0.94 to 1 .18 and had a grand mean of 0.99. Tacoma Creek mean condition factors ranged from 0.90 to 1 .19 with and overall mean of 0.96. Brook trout in Ruby Creek had mean condition factors that ranged from 0.92 to 0.97 with a mean of 0.94.

3.3.1.3 CUTTHROAT TROUT

Scale samples were collected from 5 cutthroat trout in Cee Cee Ah Creek for age determination and back-calculation of growth. Cutthroat trout mean growth in the first year ranged from 87 to 109 mm with a grand mean of 96 mm (Table 3.36). Mean length after the second year of growth was 135 mm.

Fourteen cutthroat trout scale samples were collected in Tacoma Creek. Mean lengths at the first annulus ranged from 102 to 131 mm with a grand mean of 113 mm (Table 3.37). After the **second year of** growth, mean lengths ranged from 159 to 172 mm with an overall mean of 170 mm. Back-calculated lengths for the only cutthroat caught in Tacoma over 2 years old showed a length at the third annulus of 233 mm and a length at the fourth annulus of 276 mm.

Table 3.32. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout in LeClerc Creek.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS		
COHORT	N	1	2	3
1987	18	95±20.7		
1986	21	83±10.2	116±16.2	
1985	4	92±16.7	143±14.9	188±23.0
GRAND MEAN		N=43 89±16.6	N=25 121±18.7	N=4 188±23.0
MEAN ANNUAL GROWTH INCREMENT		89	32	67

Table 3.33. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout in Tacoma Creek.

		MEAN ± SD. BACK-CALCULATED LENGTH AT ANNULUS		
COHORT	N	1	2	3
1987	39	77k28.3		
1986	70	81±14.1	122±1 9.9	
1985	1	88	107	198
GRAND MEAN		N=110 80±20.3	N=71 122±19.8	N=1 198
MEAN ANNUAL GROWTH INCREMENT		80	42	76

Table 3.34. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout in Ruby Creek.

COHORT	N	MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS 1	2
1987	12	86±13.0	
1986	4	94±10.7	147±11.5
GRAND MEAN		N=16 88±12.6	N=4 147±11.5
MEAN ANNUAL GROWTH INCREMENT		88	59

Table 3.35. Mean weights, lengths, **and condition factors (K_{TL})** for **each** age class of brook trout **in the Pend Oreille River tributaries.**

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
Skookum Creek				
0+	17	3.7±1.3	69.5±9.7	1.08f0.25
1+	15	14.9±4.1	114.0±10.9	0.99±0.11
2+	14	50.6±25.0	161.6±21.0	1.10±0.15
3+	2	267±130.1	277.5±70.0	1.25±0.32
Total	48			1.07±0.20
Cee Cee Ah Creek				
o+	10	4.7f2.3	76.7f13.7	0.95±0.15
1+	11	16.4f3.6	119.8f8.2	0.94f0.07
2+	5	38.2f18.5	157.2f22.7	0.93±0.02
3+	1	150	236	1.14
Total	27			0.95f0.11
LeClerc Creek				
o+	11	4.6f0.9	77.6f7.1	0.98f0.18
1+	10	12.9f3.1	108.2f9.3	I.O1fO.10
2+	15	34.6±15.0	151.3±21.7	0.94f0.07
3+	4	172.8f58.6	241.8f28.4	1.18f0.07
Total	40			0.99±0.13
Tacoma Creek				
0+	9	3.2±1.9	65.7±12.3	0.96±0.24
1+	22	10.4±5.2	102.0±15.0	0.90±0.15
2+	30	32.9±11.2	147.4±16.2	0.99±0.12
3+	1	120	216	1.19
Total	62			0.96±0.16
Ruby Creek				
o+	10	3.8±2.0	73.4±10.3	0.92±0.29
1+	10	16.7f6.2	119.9f16.1	0.93f0.09
2+	8	60.9f27.6	181.0f20.4	0.97f0.12
Total	28			0.94f0.19

Scale samples were collected from 11 cutthroat trout in Ruby Creek for ages determination and back-calculation of growth. Mean length after the first year of growth ranged from 95 to 101 mm with a mean of 97 mm (Table 3.38). Mean length after the second year of growth was 157 mm.

Mean condition factors for Cee Cee Ah cutthroat trout ranged from 0.83 to 0.99 with an overall mean of 0.91 (Table 3.39). Tacoma Creek cutthroat trout condition factors ranged from 0.86 to 0.99 with the grand mean at 0.91. Mean condition factors in Ruby Creek ranged from 0.95 to 0.99 and the grand mean was 0.96.

3.3.2 RIVER AND SLOUGHS

3.3.2.1 LARGEMOUTH BASS

A total of 1,076 scale samples were collected from largemouth bass in the river and sloughs for age determination and back-calculation of growth. Largemouth bass average lengths at the first annulus ranged from 61 to 80 mm with the grand mean at 66 mm (Table 3.40). Mean lengths at the second annulus ranged from 93 to 114 mm with the overall mean at 102 mm. Mean lengths at the formation of the third annulus ranged from 124 to 163 mm and the grand mean was 142 mm. At the end of the fourth years growth mean lengths ranged from 161 to 206 mm with a grand mean of 198 mm. Mean lengths after the fifth year of growth ranged from 190 to 252 mm and the mean was 241 mm. At the sixth annulus, mean lengths ranged from 222 to 290 mm with the overall mean at 280 mm. Mean lengths after the seventh year of growth ranged from 251 to 330 mm and the grand mean was 317 mm. Mean lengths after the eighth year of growth ranged from 291 to 366 with the grand mean at 355 mm. At the end of the ninth year of growth the mean lengths of largemouth bass ranged from 332 to 398 mm with an overall mean of 387 mm. Mean length at the formation of the tenth annulus ranged from 363 to 433 mm with the grand mean at 412 mm. After the eleventh year of growth the mean lengths ranged from 393 to 441 mm and the grand mean was 427 mm. Mean lengths after 12 years of growth ranged from 428 to 470 mm with a grand mean of 461 mm. After 13 years of growth the mean lengths ranged from 451 to 484 mm with the mean at 467 mm. Mean length at the formation of the fourteenth annulus was 473 mm.

The largest annual growth increment, after the first year, was 56 mm between the third and fourth annulus (2+ fish) (Table 3.40).

Table 3.36. Mean back-calculated length at the end of each years growth (annulus formation) for each year class of cutthroat trout in Cee Cee Ah Creek.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS	
COHORT	N	1	2
1987	3	87±3.5	
1986	2	109±15.2	135±12.1
GRAND MEAN		N=5 96±14.38	N=2 135±12.1
MEAN ANNUAL GROWTH INCREMENT		96	39

Table 3.37. Mean back-calculated length at the end of each years growth (annulus formation) for each year class of cutthroat trout in Tacoma Creek.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS			
COHORT	N	1	2	3	4
1987	8	102f12.1			
1986	5	131f5.9	172f13.1		
1984	1	104	159	223	276
GRAND MEAN		N=14 113±17.0	N=6 170±12.7	N=1 233	N=1 276
MEAN ANNUAL GROWTH INCREMENT		113	57	63	43

Table 3.38. Mean back-calculated length at the end of each years growth (annulus formation) for each year class of cutthroat trout in Ruby Creek.

		MEAN ± SD. BACK-CALCULATED LENGTH AT ANNULUS	
COHORT	N	1	2
1987	7	95±17.9	
1986	4	101±10.4	157±23.6
GRAND MEAN		N=11 97±15.3	N=4 157±23.6
MEAN ANNUAL GROWTH INCREMENT		97	60

Table 3.39. Mean weights, lengths, and condition factors (K_{TL}) for each age class of cutthroat trout in Pend Oreille River tributaries.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
Cee Cee Ah Creek				
o+	2	8.5±0.7	95.0±1.4	0.99f0.04
1 +	2	14.0f7.1	117.5f23.3	0.83f0.06
0 Total	4.	9 1	f 0	. 1 0
Tacoma Creek				
0 +	5	7.6±1.7	95.6±4.7	0.86±0.13
1 +	6	25.2±8.4	140.3±15.0	0.88±0.07
2 +	4	81.8±20.7	201.2±21.5	0.99±0.09
Total	15			0.91±0.10
Ruby Creek				
0 +	3	2.7±1.2	65.7±9.4	0.95±0.30
1 +	5	24.8±5.8	137.4±5.9	0.95±0.15
2 +	6	78.2±37.5	193.8±24.2	0.99±0.18
Total	14			0.96±0.18

Table 3.40. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of largemouth bass

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS													
COHORT	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1987	76	62±8.5													
1986	124	63±8.9	96±13.3												
1985	359	61±7.4	93±12.2	124±16.4											
1984	102	69±10.1	110±18.1	150±21.0	185±24.2										
1983	89	72±9.2	114±18.1	163±21.5	205±22.1	242±22.8									
1982	150	72±9.3	113±15.5	160±19.2	206±20.0	245±21.4	282±22.8								
1981	73	71±9.8	107±12.6	152±24.3	197±24.7	240±29.4	281±29.0	319±28.6							
1980	23	67±10.3	103±16.9	146±20.9	190±24.4	234±28.0	277±30.1	323±31.3	361±32.9						
1979	35	69±10.4	108±15.0	152±19.4	199±19.0	240±22.7	283±27.8	322±25.3	362±25.6	398±26.1					
1978	19	71±10.2	108±17.9	155±23.6	204±35.4	252±45.8	290±48.8	330±44.0	366±39.5	398±40.2	433±33.7				
1977	13	64±12.9	98±17.9	134±20.0	176±27.1	215±22.2	256±26.6	290±31.7	328±36.1	363±35.9	395±33.9	427±31.5			
1976	9	64±6.4	97±9.6	132±10.6	178±19.4	220±21.0	267±26.4	307±34.7	350±35.3	383±28.3	414±23.4	441±15.9	470±13.4		
1975	2	62±19.1	101±8.0	141±3.0	179±15.5	209±17.1	232±35.8	264±27.0	299±22.9	336±7.3	363±5.2	393±5.5	450±16.9	484±28.5	
1974	2	80±4.2	97±1.1	137±13.6	161±7.5	190±15.1	222±15.0	251±14.9	291±37.3	332±30.7	365±53.1	396±54.3	428±46.5	451±40.4	473±34.3
GRAND MEAN		N=1076 66±9.7	N=1000 102±16.8	N=876 142±24.8	N=517 198±24.6	N=415 241±26.2	N=326 280±28.6	N=176 317±32.9	N=103 355±35.8	N=80 387±36.0	N=45 412±37.8	N=26 427±30.3	N=13 461±24.4	N=4 467±34.2	N=2 473±34.3
MEAN ANNUAL GROWTH INCREMENT		66	36	40	56	43	39	37	38	32	25	15	34	6	6

Growth rates generally decline after the fourth year of growth to a low of 6 mm between the twelfth and thirteenth and fourteenth annuli formation. Table 3.41 shows the mean weights, mean lengths, and mean condition factors for each age class of largemouth bass. Condition factors were lowest for 3+ fish at 1.14 and then increased to 1.82 for 12+ largemouth bass. The overall mean condition factor was 1.30.

3.3.2.2 YELLOW PERCH

Scale samples were collected from 1,002 yellow perch from the Pend Oreille River and sloughs. Back-calculated lengths at the first annulus averaged from 68 to 82 mm and the grand mean was 77 mm (Table 3.42). Mean lengths after the second year of growth ranged from 92 to 101 mm with a grand mean of 95 mm. After the third year of growth mean lengths ranged from 110 to 122 mm with an overall mean of 114 mm. Mean lengths at the formation of the fourth annulus ranged between 133 to 146 mm with a grand mean of 134 mm. After five years of growth, mean lengths ranged from 149 to 168 mm with the grand mean at 150 mm. Mean lengths after 6 years of growth ranged from 165 to 185 mm with a grand mean of 166 mm. Mean length at the seventh annulus formation was 206 mm.

Mean condition factors for each age class of yellow perch ranged from a low of 0.97 for 6+ and a high of 1.12 for 2+ (Table 3.43). The mean for all yellow perch was 1.04.

3.3.2.3 MOUNTAIN WHITEFISH

Scale samples were collected from 546 mountain whitefish for age determination and back-calculation of growth. Mean lengths at the end of the first year of growth ranged from 136 to 188 mm with the mean at 174 mm (Table 3.44). Back-calculated mean lengths at the second annulus were from 189 to 233 mm with the grand mean at 219 mm. Mean lengths after the third year of growth ranged from 249 to 282 mm with the grand mean at 259 mm. After four years of growth, mean lengths ranged from 289 to 331 mm and the grand mean was 299 mm. Mean back-calculated lengths ranged from 343 to 371 mm with a grand mean of 360 mm after the fifth year of growth. Mean lengths at the formation of the sixth annulus ranged from 374 to 408 mm with the grand mean at 390 mm. After 7 years of growth, mean lengths ranged from 406 to 415 mm with a grand mean of 413 mm. Mean length after 8 years was 435 mm.

Table 3.41. Mean weights, lengths, and condition factors (K_{TL}) for each age class of largemouth bass.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
0+	12	2.8±0.7	57.2±4.1	1.49±0.27
1+	55	7.2±2.4	81.0±7.9	1.33±0.24
2+	79	18.6±7.2	116.0±15.9	1.16±0.20
3+	195	34.8±15.0	142.7±17.9	1.14±0.13
4+	59	109.5±46.7	203.7±28.9	1.22±0.16
5+	51	252.3±63.6	265.6±17.6	1.32±0.17
6+	85	417.7±110.7	306.7±21.6	1.42±0.17
7+	50	625.7±148.0	344.5±22.7	1.51±0.19
8+	14	994.2±288.2	387.7±29.1	1.66±0.20
9+	17	1320.6±384.7	427.4±30.1	1.65±0.25
10+	11	1495.8±221.5	443.4±22.5	1.71±0.15
11+	10	1608.8±445.0	451.6±29.4	1.71±0.23
12+	7	2144.0±352.7	489.3±15.9	1.82±0.22
13+	1	2433	523	1.70
14+	2	2150.5±29.0	498.5±7.8	1.74±0.06
Total	648			1.30±0.25

Table 3.42. Mean back-calculated lengths at the end of each years growth (**annulus** formation) for each year class of yellow perch.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS						
COHORT	N	1	2	3	4	5	6	7
1987	21	68±8.3						
1986	35	74±8.4	94±12.0					
1985	214	75±5.0	92±6.7	110±9.2				
1984	308	77±4.9	96±7.9	116±10.8	133±12.9			
1983	268	78±4.2	97±7.0	116±9.5	134±11.1	149±10.7		
1982	150	79±4.7	96±6.6	114±8.4	133±11.4	150±12.3	165±12.1	
1981	6	82±1.7	101±7.8	122±11.0	146±13.7	168±14.5	185±18.5	206±12.3
GRAND MEAN		N=1002 77±5.3	N=981 95±7.6	N=946 114±10.0	N=732 134±12.0	N=424 150±11.6	N=156 166±12.9	N=6 206±12.3
MEAN ANNUAL GROWTH INCREMENT		77	18	19	20	16	16	40

Table 3.43. Mean weights, lengths, and condition factors **(K_{TL})** for each age class of yellow perch.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
1+	20	5.4±2.8	79.5±10.6	0.99±0.20
2+	20	15.8f4.8	111.0f10.2	1.12k0.18
3+	142	20.6f5.8	122.3f9.9	1.10±0.13
4+	229	33.8±9.0	144.7±12.9	1.09f0.15
5+	200	41.5±8.6	160.7±9.7	0.99±0.11
6+	117	52.5f13.2	175.0f11.3	0.97f0.12
7+	3	89.7±18.0	208.0f16.1	0.99f0.04
Total	731			1.04±0.14

Mean condition factors for each age class of mountain whitefish ranged from 0.69 for 0+ fish to 0.81 for 7+ fish (Table 3.45). The mean condition factor for all age classes combined was 0.71.

3.3.2.4 BLACK CRAPPIE

Scale samples were collected from 174 black crappie for age determination and back-calculation of growth. Mean back-calculated lengths at the first annulus ranged from 56 to 77 mm with the grand mean at 72 mm (Table 3.46). After the second year of growth mean lengths ranged from 92 to 116 mm with a grand mean of 104 mm. Mean lengths ranged from 130 to 153 mm after the third year of growth and the grand mean was 136 mm. After the fourth year of growth mean lengths ranged from 146 to 183 mm with the grand mean at 170 mm. Mean lengths after 5 years of growth was 178 to 212 mm and the grand mean was 209 mm. Mean lengths at the formation of the sixth annulus ranged from 216 to 233 mm and the grand mean was 228 mm. Mean length at the formation of the seventh annulus was 241 mm.

Mean condition factors for each age class of black crappie ranged from 1.34 for 2+ to 1.68 for 7+ (Table 3.47). The grand mean condition factor for all black crappie was 1.39.

3.3.2.5 BROWN TROUT

Scale samples were collected from 115 brown trout for age determination and back-calculation of growth. At the end of the first year of growth, brown trout averaged in length from 75 to 110 mm with a grand mean of 98 mm (Table 3.48). At the end of the second years growth mean lengths ranged from 139 to 184 mm with the grand mean at 167 mm. Mean lengths after the third year of growth ranged from 217 to 265 mm with a grand mean of 249 mm. After 4 years of growth, mean lengths ranged from 307 to 347 mm and the grand mean was 341 mm. Mean lengths at the formation of the fifth annulus ranged from 386 to 415 mm with a mean of 411 mm. At the end of the sixth year of growth, mean lengths ranged from 443 to 477 mm with a mean of 468 mm. Mean length after the seventh year of growth was 507 mm.

Mean condition factors for brown trout ranged from 0.78 for 3+ fish to 1.09 for 7+ fish (Table 3.49). The mean condition factor for all fish was 0.95.

Table 3.44. Mean back-calculated lengths at the end of each years growth (**annulus** formation) for each year class of mountain whitefish.

COHORT	N	MEAN ± S.D. BACK-CALCULATED LENGTH AT **ANNULUS** 1	2	3	4	5	6	7	8
1987	46	136f18.3							
1986	63	163f16.6	189f27.0						
1985	251	179±9.0	222±15.1	256±20.2					
1984	126	182:±9.6	225±14.4	260±17.3	289±20.0				
1983	22	188±9.4	233±16.6	282±21.6	331±31.7	370±36.2			
1982	15	184±8.7	232±15.0	280±19.6	331±17.1	371±18.8	408±21.7		
1981	18	173±5.0	209±13.2	249±16.2	299±20.6	343±20.4	378±20.3	415±17.9	
1980	5	174±9.5	210±13.0	250±15.5	292±14.5	337±19.9	374±18.3	406±16.9	435±13.9
GRAND MEAN		N=546 174±17.2	N=500 219±20.7	N=437 259±20.5	N=186 299±27.0	N=60 360±30.0	N=38 390±25.4	N=23 413±17.6	N=5 435±13.9
MEAN ANNUAL GROWTH INCREMENT		174	45	40	40	61	30	23	22

Table 3.45. Mean weights, lengths, and condition factors (K_{TL}) for each age class of mountain whitefish.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
1+	38	20.0±8.5	140.5±22.1	0.69±0.06
2+	37	64.2f33.1	201.8±34.4	0.72f0.08
3+	1 13	141.2f37.1	268.5f23.2	0.72±0.10
4+	51	186.1 f39.8	295.6k21.3	0.72±0.09
5+	15	488.1 fl18.6	406.7f40.2	0.71 f0.07
6+	9	629.9±1 09.2	445.2±1 2.5	0.71 ±0.11
7+	2	597.5f46.0	419.5±5.0	Q.81 ±0.09
8+	2	714.5±139.3	466.5k23.3	0.70f0.03
Total	267			0.71f0.09

Table 3.46. Mean back-calculated lengths at the end of each years growth **(annulus** formation) for each year class of black crappie.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS						
COHORT	N	1	2	3	4	5	6	7
1987	3	56±4.8						
1986	22	72±6.5	106±8.5					
1985	86	71±5.4	102±11.5	132±16.3				
1984	44	72±5.8	104±10.6	138±11.6	166±14.0			
1983	16	77±4.0	116±9.8	153±10.1	183±12.6	212±13.2		
1982	2	77±5.0	106±25.4	135±32.5	172±47.5	201±47.1	233±43.0	
1981	1	65	92	130	146	178	216	241
GRAND MEAN		N=174 72±6.11	N=171 104±11.4	N=149 136±15.9	N=63 170±16.7	N=19 209±18.3	N=3 228±32.0	N=1 241
MEAN ANNUAL GROWTH INCREMENT		72	32	32	34	39	19	13

Table 3.47. Mean weights, lengths, and condition factors **(K_{TL})** for each age class of black crappie.

[Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
1+	3	3.7f1.5	62.3f10.5	1.52f0.52
2+	10	24.3±6.5	121.3±9.8	1.34f0.14
3+	54	44.8±16.1	146.8f17.7	1.37f0.13
4+	35	88.6±20.4	183.1±13.0	1.42k0.15
5+	13	169.0f29.1	229.7f10.2	1.39±0.12
6+	2	231.5f96.9	252.0f38.2	1.41f0.04
7+	1	428	294	1.68
Total	118			1.39±0.15

Table 3.48. Mean back-calculated lengths at the end of each years growth (**annulus** formation) for each year class of brown trout.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS						
COHORT	N	1	2	3	4	5	6	7
1987	5	75±16.2						
1986	16	83±21.4	139±26.1					
1985	23	87±20.7	148±29.2	217±36.0				
1984	26	101±20.3	178±27.3	259±34.0	340±29.8			
1983	21	108±18.2	180±34.0	265±46.7	346±49.7	415±49.8		
1982	18	110±29.4	184±32.5	262±35.0	347±42.6	414±52.8	477±59.2	
1981	6	106±10.5	174±17.3	238±28.4	307±42.3	386±33.4	443±29.8	507±38.1
GRAND MEAN		N=115 98±23.7	N=110 167±33.7	N=94 249±41.8	N=71 341±41.2	N=45 411±49.3	N=24 468±54.8	N=6 507±38.1
MEAN ANNUAL GROWTH INCREMENT		98	69	82	92	70	57	39

Table 3.49. Mean weights, lengths, and condition factors (**K_{TL}**) for each age class of brown trout.

Age	N	Mean weight (g) (±S.D.)	Mean length (mm) (±S.D.)	Mean K_{TL} (±S.D.)
1+	4	10.8±8.5	101.2±25.8	0.89±0.04
2+	13	43.0f28.2	164.7±36.4	0.88±0.11
3+	12	120.1±50.8	244.2f33.5	0.78±0.06
4+	8	438.4±123.1	366.1±26.3	0.88±0.13
5+	12	883.2±278.9	450.8±29.2	0.94±0.14
6+	13	1298.2±227.5	497.4±30.6	1.06±0.15
7+	18	1890.7±480.1	555.0k34.6	1.09f0.13
Total	80			0.95±0.16

3.3.2.6 CUTTHROAT TROUT

Scale samples were collected from 17 cutthroat trout for age determination and back-calculation of growth. Back-calculations were made using the proportional method since a good regression could not be obtained for fish length and scale length. Mean lengths at the first annulus ranged from 84 to 112 mm and the grand mean was 102 mm (Table 3.50). Mean lengths at the second annulus ranged from 157 to 189 mm with the grand mean at 176 mm. After 3 years of growth the mean lengths ranged from 215 to 254 mm and the mean for all fish was 239 mm. Mean length after the fourth year of growth was 287 mm.

Mean condition factors for cutthroat trout ranged from 0.89 for 3+ and 4+ to 1.05 for 2+ (Table 3.51). The mean for the eight fish was 0.91.

3.3.2.7 BROOK TROUT

Scale samples were collected from 3 brook trout for age determination and back-calculation of growth. Because of the small sample size a good regression between fish length and scale length could not be obtained and back-calculations were made using the proportional method. Mean lengths after the first year of growth ranged from 63 to 103 mm with the grand mean at 77 mm (Table 3.52). Mean lengths at the formation of the second annulus ranged from 120 to 140 mm and the grand mean was 126 mm. After the third year of growth the length was 191 mm. The mean condition factor for 2+ brook trout was 0.90 (Table 3.53).

3.3.2.8 RAINBOW TROUT

Scale samples were collected from 5 rainbow trout for age determination and back-calculation of growth. Back-calculations were made using the proportional method. Mean lengths after the first year of growth ranged from 94 to 119 mm with a grand mean of 105 mm (Table 3.54). After 2 years of growth, mean lengths ranged from 144 to 175 mm with the grand mean at 154 mm. Lengths after 3 years of growth ranged from 231 to 235 mm with a mean of 233 mm. After 4 years of growth the lengths ranged from 298 to 343 mm with the mean at 322 mm. The length after 5 years of growth was back-calculated to be 387 mm. for the only 5+ rainbow captured. The mean condition factor for 2+ rainbow trout was 0.86 and the condition factor for the 5+ rainbow trout was 1.03 (Table 3.55).

Table 3.50. **Mean back-calculated lengths at the end of each years growth (annulus formation) for year age class of cutthroat trout. Back-calculated lengths were obtained using the proportional method.**

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS			
COHORT	N	1	2	3	4
1987	0				
1986	1	111	161		
1985	10	112±27.6	189±21.7	254+25.3	
1984	6	84±10.2	157±18.9	215±34.4	287±37.1
GRAND MEAN		N=17 102±25.5	N=17 176±25.3	N=16 239±34.1	N=6 287±37.1
MEAN ANNUAL GROWTH INCREMENT		102	74	63	48

Table 3.51. **Mean weights, lengths, and condition factors (K_{TL}) for each age class of cutthroat trout.**

AGE	N	MEAN WEIGHT (Q) (±S.D.)	MEAN LENGTH (mm) (±S.D.)	MEAN K_{TL} (±S.D.)
2 +	1	85	201	1.05
3 +	6	241.7±105.4	296.5f32.3	0.89f0.14
4 +	1	175	270	0.89
TOTAL	8			0.91f0.13

Table 3.52. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of brook trout. Back-calculated lengths were obtained using the proportional method.

COHORT	N	MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS 1	2	3
1987	0			
1986	2	63±8.0	120±10.5	
1985	1	103	140	191
GRAND MEAN		N=3 77±23.6	N=3 126±13.8	N=1 191
MEAN ANNUAL GROWTH INCREMENT		77	49	65

Table 3.53. Mean weights, lengths, and condition factors (K_{TL}) for each age class of brook trout.

AGE	N	MEAN WEIGHT (Q) (±S.D.)	MEAN LENGTH (mm) (±S.D.)	MEAN K_{TL} (±S.D.)
2+	2	27.0k4.24	144.048.49	0.90f0.02

Table 3.54. Mean back-calculated lengths at the end of each years growth (annulus formation) for each year class of rainbow trout. Back-calculated lengths were obtained using the proportional method.

		MEAN ± S.D. BACK-CALCULATED LENGTH AT ANNULUS				
COHORT	N	1	2	3	4	5
1986	3	103±20.5	144±18.0			
1985	0					
1984	1	94	175	235	343	
1983	1	119	164	231	298	387
GRAND MEAN		N=5 105±17.1	N=5 154±19.0	N=2 233±3.2	N=2 321±32.0	N=1 387
MEAN ANNUAL GROWTH INCREMENT		105	49	79	88	66

Table 3.55. Mean weights, lengths, and condition factors (K_{TL}) for each age class of rainbow trout

AGE	N	MEAN WEIGHT (Q) (±S.D.)	MEAN LENGTH (mm) (±S.D.)	MEAN K_{TL} (±S.D.)
2 +	3	73.3±31.0	202.7±31.0	0.86f0.12
5 +	1	1283	499	1.03
TOTAL	4			0.90±0.13

3.3.2.9 NON-TARGET SPECIES

Back-calculated lengths for pumpkinseed, northern squawfish, largescale sucker, peamouth, tench, longnose sucker, and redside shiner can be found in Appendix D. All back-calculations were accomplished using the Lee method except for redside shiner which was back-calculated using the proportional method. Sample sizes are generally small due to the fact that these species were not target species for this study. Mean lengths, weights, and condition factors for some of these species can also be found in Appendix D.

3.4 FOOD AVAILABILITY IN THE RIVER, SLOUGHS, AND TRIBUTARIES

3.4.1 BENTHIC MACROINVERTEBRATE DENSITIES IN THE TRIBUTARIES AND INVERTEBRATE ABUNDANCE IN THE DRIFT

Mean densities of benthic macroinvertebrates in Hess samples ranged from a high of 5,921 organisms/m2 in Cee Cee Ah Creek to a low of 4,823 organisms/m2 in LeClerc Creek (Table 3.56). Chironomidae larvae were the most abundant organism in all tributaries except Cee Cee Ah Creek where Elmidae larvae was the most abundant (Table 3.57). Baetidae were common in most of the tributaries as were Ephemerellidae and Heptageniidae.

Mean densities of invertebrates in the drift ranged from a high of 282 organisms/l00 m^3 in Skookum Creek to a low of 68 organisms/l 00 m^3 in Cee Cee Ah Creek (Table 3.58). Chironomidae larvae were the most abundant organisms in the drift in three of the four tributaries (Table 3.59). Elmidae adults were the most abundant drift organisms in Tacoma Creek. Other common families in the drift included Baetidae, Elmidae larvae, Chironomidae pupae, and Brachycentridae. Of the most common invertebrates in the drift, only Chironomidae adults, in LeClerc Creek, and Aphididae, in Skookum Creek, were terrestrial.

Shannon-Weiner diversity for benthic macroinvertebrates was highest in Skookum Creek with a value of 3.908 (Table 3.60). Cee Cee Ah had the next highest diversity at 3.683 followed by LeClerc Creek at 3.644 and Tacoma Creek was lowest with a value of 3.476. The diversity value calculated for the drift was highest in Cee Cee Ah Creek at 3.875 (Table 3.61). The next highest diversity was 3.78

Table 3.56. Mean benthic macroinvertebrate densities (#/m^2) collected in Pend Orellle tributaries. Sample sizes enclosed in parentheses.

	LECLERC	CCA	TACOMA	SKOOKUM
APRIL	8211 (3)	566 (3)	1230 (3)	*
JUNE	1756 (3)	5153 (3)	1937 (3)	6772 (3)
JULY	4525 (3)	7240 (3)	10127 (3)	4813 (3)
SEPTEMBER	4970 (4)	8177 (4)	8105 (2)	1145 (4)
OCTOBER	4652 (4)	5180 (4)	6280 (2)	7150 (4)
ANNUAL MEAN	4823 (17)	5921 (17)	4907 (13)	4972 (14)

* No samples collected.

Table 3.57. Mean number and percent composition of macroinvertebrates per square meter (collected by Hess sampler) in tributaries to the Pend Oreille River, WA.

	LECLERC CREEK		CEE CEE AH CREEK		TACOMA CREEK		SKOOKUM CREEK	
	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%
TRICHOPTERA (Caddisflies)								
Glossosomatidae	101.8	2.1	139.4	2.4	56.0	1.1	169.3	3.4
Brachycentridae	274.0	5.7	319.2	5.4	263.0	5.4	89.5	1.8
Hydropsychidae	106.4	2.2	127.2	2.1	197.8	4.0	21.3	0.4
Hydroptilidae			16.2	0.3	12.0	0.2	3.8	0.08
Limnephilidae	12.0	0.2	16.4	0.3	7.6	0.2	13.3	0.3
Rhyacophilidae	178.4	3.7	106.2	1.8	69.4	1.4	252.5	5.1
Leptoceridae					3.0	0.06	11.8	0.2
Lepidostomatidae							0.8	0.02
Philopotamidae						0.6	0.01	
T. pupae	35.6	0.7	12.4	0.2	10.0	0.2	3.3	0.07
EPHEMEROPTERA (Mayflies)								
Heptageniidae	395.8	8.2	867.0	14.6	119.0	2.4	441.8	8.9
Ephemerellidae	404.2	8.4	281.6	4.8	404.6	8.2	206.3	4.1
Baetidae	735.6	15.3	680.6	11.5	474.4	9.7	487.3	9.8
Leptophlebiidae	1.4	0.03	38.2	0.6	183.6	3.7	33.5	0.7
PLECOPTERA (Stoneflies)								
Chloroperlidae	213.8	4.4	237.6	4.0	88.2	1.8	260.0	5.2
Perlidae	8.0	0.2	15.4	0.3	0.6	0.01	113.3	2.3
Perlodidae	4.0	0.08	12.8	0.2	6.0	0.1	23.8	0.5
Peltoperlidae			17.2	0.3				
Nemouridae	26.6	0.6	61.6	1.0	20.0	0.4	26.8	0.5
Leuctridae					0.6	0.01		
COLEOPTERA (Beetles)								
Elmidae larvae	423.8	8.8	1196.8	20.2	912.2	18.6	277.8	5.6
Elmidae adults	13.6	0.3	69.6	1.2	76.0	1.5	4.3	0.09
DIPTERA (Midges and flies)								
Chironomidae larvae	764.8	15.9	934.2	15.8	1312.2	26.7	1249.5	25.1
Chironomidae pupae	17.2	0.4	16.0	0.3	27.0	0.6	45.0	0.9
Ceratopogonidae	19.2	0.4	13.0	0.2	28.2	0.6	13.0	0.3
Tipulidae	66.6	1.4	102.4	1.7	75.8	1.5	74.5	1.5
Simuliidae	123.0	2.6	124.6	2.1	167.4	3.4	19.5	0.4
Tabanidae	6.0	0.1	5.6	0.09	0.6	0.01	0.8	0.02
Empididae	13.0	0.3	1.0	0.02	10.6	0.2	2.5	0.05
Psychodidae	3.0	0.06			197.0	4.0		
LEPIDOPTERA (Moths)								
Pyralidae								
HYDRACARINA (Mites)	20.6	0.4	97.2	1.6	32.0	0.7	49.0	1.0
COPEPODA (Copepods)								
Harpacticoid			6.0	0.1	6.6	0.1	0.8	0.02
AMPHIPODA (Scuds)								
Gammaridae							191.8	3.9
Talitridae			2.6	0.04	7.0	0.1	5.8	0.1
CLADOCERA (Cladocera)							15.5	0.3
Daphnidae								
Chydoridae								

Table 3.57. (cont.)

	LECLERC CREEK		CEE CEE AH CREEK		TACOMA CREEK		SKOOKUM CREEK	
	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%
OSTRACODA (Seed shrimp)	0 6	0 01	21 6	0.4				
OLIGOCHAETA (Worms)								
Lumbriculidae	30.4	0.6	56.8	1.0	15.0	0.3	20.8	0 4
Naididae	714.6	14 8	118 6	2 0	49 0	1 0	650 0	131 1
NEMATODA	25.2	0.5	14.0	0 2	2 0	0.04	58 3	1.2
TURBELLARIA (Flatworms)								
Planariidae	54 4	1.1	78 6	1 3	21 4	0 4	103 8	2 1
HIRUDINEA (Leeches)								
MOLLUSCA (Snails)								
Planorbidae	1.4	0.03	22.2	0.4	8.6	0 2		
Physidae								
Lymnaeidae			0 6	0.01				
BIVALVIA (Clams)								
Sphaeriidae	0.6	0 01	50.0	0 8	27.0	0.6	9.5	0.2
TERRESTRIALS								
DIPTERA (Midges and flies)								
Chironomidae	0.6	0.01	1 6	0.03	4 1	3 7		
Ceratopogonidae							2 2	0 8
Simuliidae	2 6	0 05			3 8	0 08	3 8	0.08
Culicidae			0.6	0.01				
EPHEMEROPTERA (Mayflies)								
Baetidae					1 0	0.02		
COLEOPTERA (Beetles)								
Buprestidae								
Curculionidae			1 0	0.02				
Cerambycidae								
HEMIPTERA (True bugs)			0 6	0.01	1 2	0 02	1 8	0 04
HOMOPTERA (Leaf bugs)								
Aphididae	1.6	0.03	4.4	0 07	4 6	0.1	3 8	0 08
Coccidae			0 6	0.01	3 0	0.06		
Cicadellidae								
COLLEMBOLA (Springtails)								
Entomobryidae	5 6	0 1					3.8	0.08
PSOCOPTERA (Psocids)								
Psocidae	1.0	0 8	0.4	0 6	0.9	0 8	0 4	0.1
Polypsocidae	0 2	0 2					0.3	0.1
Pseudocaeciliidae	2.0	0 04	0 6	0 01	0.6	0.01	2 5	0.05
HYMENOPTERA (Bees)								
Apidae			0.6	0.01				
Formicidae								
Eulophidae								
NEUROPTERA (Lacewings)								
Chrysopidae							1 3	0 03
THYSANOPTERA								
Thripidae								
DIPLOPODA (Millipedes)							1 3	0 03
ARANEIDA (Spiders)							0.8	0 02
UNKNOWN TERRESTRIALS	10.2	0 2	26.8	0.5	4.6	0.09	1 8	0.04
TOTAL	4823		5921		4907		4972	

Table 3.58. Mean drift densities **(#/100 m^3)** of organisms collected in Pend **Oreille** tributaries. Sample sizes enclosed in parentheses.

	LECLERC	CEE CEE AH	TACOMA	SKOOKUM
JUNE	**52 (2)**	**57 (2)**	**31 (2)**	*
JULY	**23 (2)**	**28 (2)**	**233 (2)**	**a2 (2)**
SEPTEMBER	**112 (4)**	**96 (4)**	**70 (4)**	**726 (4)**
OCTOBER	**295 (4)**	**89 (4)**	*	**40 (4)**
ANNUAL MEAN	**127 (12)**	**68 (12)**	**111 (8)**	**282 (10)**

* No samples collected.

Ta bie 3.59. Mean number and percent composition of macroinvertebrates per 100 cubic meters (collected by drift sampler) in tributaries to the Pend Oreiiie River, WA.

	LECLERC CREEK		CEE CEE AH CREEK		TACOMA CREEK		SKOOKUM CREEK	
	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%
TRICHOPTERA (Caddisflies)								
Glossosomatidae	0.6	0.5	0.1	0.1				
Brachycentridae	9.6	7.6	6.5	9.6	3.2	2.9	2.9	1.0
Hydropsychidae	0.3	0.2	1.4	2.1	1.0	0.9	0.6	0.2
Hydroptilidae	0.1	0.1	0.6	0.9			0.3	0.1
Limnephilidae	1.3	1.0	1.8	2.7	0.6	0.5		
Rhyacophilidae	8.1	6.4	1.3	1.9	0.3	0.3	3.6	1.3
Leptoceridae	0.8	0.6					0.2	0.1
Lepidostomatidae			0.2	0.3				
Psychomyiidae			0.1	0.1				
Philopotamidae	0.4	0.3						
Helicopsychidae			0.1	0.1				
EPHEMEROPTERA (Mayflies)								
Heptageniidae	5.6	4.4	1.1	1.6			3.0	1.0
Ephemerellidae	6.8	5.4	4.9	7.2	9.9	8.9	2.6	0.9
Baetidae	11.1	8.8	5.2	7.7	3.6	3.2	28.9	10.2
Leptophlebiidae	0.5	0.4	0.1	0.1				
PLECOPTERA (Stoneflies)								
Chloroperlidae	2.6	2.0					0.8	0.3
Perlidae	0.1	0.1	4.5	6.6				
Perlodidae	5.5	4.3			0.6	0.5		
Peltoperlidae	2.7	2.1						
Nemouridae	11.2	8.8	0.2	0.3			3.0	1.1
Leuctridae	0.4	0.3						
Pteronarcyidae							0.2	0.1
COLEOPTERA (Beetles)								
Elmidae larvae			6.2	9.1	10.2	9.2	12.8	4.5
Elmidae adults			1.0	1.5	27.4	24.7	0.5	0.2
Psephenidae			0.1	0.1				
Lampryidae							0.1	0.04
DIPTERA (Midges and flies)								
Chironomidae larvae	21.2	16.7	6.8	10.0	8.9	8.0	178.0	63.0
Chironomidae pupae	4.4	3.5	0.8	1.2	19.5	17.6	16.1	5.7
Ceratopogonidae	0.3	0.2						
Tipulidae	0.4	0.3	1.0	1.5			0.6	0.2
Simuliidae	2.1	1.7	3.7	5.5	5.8	5.2	2.5	0.9
Tabanidae			0.1	0.1			0.9	0.3
Empididae							0.3	0.1
Psychodidae	0.1	0.1	0.4	0.6	0.3	0.3	1.2	0.4
Stratiomyidae			0.1	0.1				
Culicidae			0.2	0.3				
Blephariceridae							0.3	0.1
LEPIDOPTERA (Moths)								
Pyralidae					0.2	0.2		
HYDRACARINA (Mites)	2.8	2.2	2.6	3.8	4.4	4.0	2.5	0.9
OSTRACODA (Seed shrimp)			1.6	2.4			0.2	0.1

Table 3.59. (cont.)

	LECLERC CREEK		CEE CEE AH CREEK		TACOMA CREEK		SKOOKUM CREEK	
	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%
OLIGOCHAETA (Worms)								
Lumbriculidae	0.1	0.1	0.5	0 7	0 4	0.4	0.2	0 1
Naididae	1.3	1.0	0.2	0.3			0.9	0 3
NEMATODA (Nematodes)	0.3	0.2					0 2	0.1
TURBELLARIA (Flatworms)								
Planariidae	0 6	0.5						
HIRUDINEA (Leeches)								
MOLLUSCA (Snails)								
Planorbidae	0.3	0.2	0.3	0.4			0.6	0 2
Physidae								
Lymnaeidae			0.3	0.4	0.1	0.09		
BIVALVIA (Clams)								
Sphaeriidae	0.2	0.2	4.4	6 5	0.2	0 2	6 5	2.3
TERRESTRIALS								
DIPTERA (Midges and flies)								
Chironomidae	9.0	7.1	1 7	2.5	4.1	3.7		
Ceratopogonidae							2 2	0.8
Simuliidae	0.3	0.2	0.1	0.1				
Empididae	0.3	0.2						
Mycetophilidae			0.2	0.3				
Drosophilidae			0.1	0.1				
Sciaridae							0 5	0 2
EPHEMEROPTERA (Mayflies)								
Baetidae	3.6	2.8	1.2	1.8			0 4	0.1
Duns	0.2	0.2						
COLEOPTERA (Beetles)								
Buprestidae			0.2	0.3			0.2	0 1
Cerambycidae	0.1	0.1						
HEMIPTERA (True bugs)								
Mesoveliidae					0.2	0 2		
Gerridae	0.4	0.3			0.1	0 09		
HOMOPTERA (Aphids)								
Aphididae	6.0	4.7	2.7	4.0	4 2	3 8	7.0	2.5
Coccidae							0.3	0.1
PSOCIDAE (Psocids)								
Psocidae	1.0	0.8	0.4	0.6	0.9	0 8	0.4	0.1
Polypsocidae	0.2	0 2					0.3	0.1
HYMENOPTERA (Bees)								
Apidae	0.5	0 4						
Formicidae	0.3	0 2	0.7	1.0			0 3	0 1
Sphecidae					0.2	0.2		
Eurytomidae							0.3	0.1
Chalcidae							0.3	0 1
TRICHOPTERA (Caddisflies)								
Limnephilidae	0.1	0.1						
ARANEIDA (Spiders)								
UNKNOWN TERRESTRIALS			1.9	2.8				
TOTAL	127.0		68.0		111.0		283.0	

Table 3.60. Shannnon-Weiner diversity indices for benthic macroinvertebrates collected in each tributary.

LECLERC CREEK		CEECEEAHCREEK	
# Taxa	30	# Taxa	35
# Individuals	4823	# Individuals	5921
Simpson Dom.	.104	Simpson Dom.	.117
Shannon Div.	3.644	Shannon Div.	3.683
D-max	4.906	D-max	5.129

TACOMA CREEK		SKOOKUM CREEK	
# Taxa	35	# Taxa	33
# Individuals	4907	# Individuals	4972
Simpson Dom.	.143	Simpson Dom.	.091
Shannon Div.	3.476	Shannon Div.	3.908
D-max	5.129	D-max	5.044

Table 3.61. Shannon-Weiner diversity indices for organisms collected in the drift for each tributary.

LECLERC CREEK		CEE CEE AH CREEK	
# Taxa	32	# Taxa	29
# Individuals	127	# Individuals	33
Simpson Dom.	.095	Simpson Dom.	.071
Shannon Div.	3.78	Shannon Div.	3.875
D-max	5.0	D-max	4.857

TACOMA CREEK		SKOOKUM CREEK	
# Taxa	28	# Taxa	17
# Individuals	282	# Individuals	111
Simpson Dom.	.488	Simpson Dom.	.205
Shannon Div.	1.938	Shannon Div.	2.7
D-max	4.807	D-max	4.087

in LeClerc Creek. Skookum Creek diversity was 2.7 and Tacoma Creek diversity was 1.938.

The relative abundance of the top five benthic macroinvertebrates found in the trout diet are in Table 3.62. Chironomidae were the most abundant family in all four tributaries making up from 16.1 to 27.3 percent. Baetidae were next ranging from 9.7 to 15.3 percent followed by Ephemerellidae (4.1 to 8.4%), Brachycentridae (1.8 to 5.7%), and Limnephilidae (0.2 to 0.3%). Of the common prey items in the trout diet, Chironomidae were the most abundant in the drift ranging from 8.9 to 64.7 percent of the total number of organisms in the drift samples (Table 3.63). Brachycentridae were next, ranging from 1 .O to 19.9 percent, followed by Baetidae (2.4 to 10.2%), Ephemerellidae (0.9 to 8.9%), and Limnephilidae (0.0 to 1.8%).

The calculated Kruskal-Wallis H value for the densities of the top five prey items in trout diets was 0.257 for benthic macroinvertebrates and 3.39 for invertebrates in the drift. Since these values are less than the table value of 7.5 for 4 groups of 5 members (Zar 1984), the null hypothesis (i.e., that their was no significant difference in benthic and drift invertebrate densities between the tributaries) could not be rejected.

The mean monthly densities for benthic macroinvertebrates and invertebrates in the drift can be found in Appendix E, Tables E.l through E.8.

3.4.2 BENTHIC MACROINVERTEBRATE DENSITIES IN THE RIVER AND SLOUGHS

Mean annual densities of benthic macroinvertebrates in the river ranged from 4,508 organisms/m* at study site 1 to 17,234 organisms/m* at study site 7 (Table 3.64). Chironomidae larvae were the most abundant organism in the benthos of the river making up 32.3 percent of the organisms sampled (Table 3.65). Oligochaeta was next at 31 .1 percent, followed by Sphaeriidae (7.8%), Elmidae (4.3%), Planorbidae (3.0%), and Nematoda (2.5%).

Mean annual densities of benthic macroinvertebrates in the sloughs ranged from 6,415 organisms/m* at study site 4A to 13,354 organisms/m* at study site 5A (Table 3.66). Oligochaeta was generally the most abundant group of organisms in the sloughs

Table 3.62. Mean density (#/m²) of preferred prey items collected in benthic samples for each tributary. Percent composition of organisms are enclosed in parentheses.

DENSITY OF PREFERRED PREY ITEMS IN BENTHIC SAMPLES				
PREY ITEM	**LECLERC**	**CCA**	**TACOMA**	**SKOOKUM**
LIMNEPHILIDAE	12 (0.2%)	16 (0.3%)	8 (0.2%)	13 (0.3%)
CHIRONOMIDAE	782 (16.3%)	950 (16.1%)	1339 (27.3%)	1295 (26%)
BAETIDAE	736 (15.3%)	681 (11.5%)	474 (9.7%)	487 (9.8%)
EPHEMERELLIDAE	404 (8.4%)	282 (4.8%)	405 (8.2%)	206 (4.1%)
BRACHYCENTRIDAE	274 (5.7%)	319 (5.4%)	263 (5.4%)	90 (1.8%)

Table 3.63. Mean density (#/100 m³) of preferred prey items collected in drift samples. Percent compostion of organism are enclosed in parentheses.

DENSITY OF PREFERRED PREY ITEMS IN DRIFT SAMPLES				
PREY ITEM	LECLERC	CCA	TACOMA	SKOOKUM
LIMNEPHILIDAE	1 (1.0%)	6 (1.8%)	1 (0.5%)	0
CHIRONOMIDAE	20 (20.2%)	9 (8.9%)	26 (25.6%)	63 (64.7%)
BAETIDAE	9 (8.8%)	2 (2.4%)	3 (3.2%)	1 (10.2%)
EPHEMERELLIDAE	5 (5.4%)	3 (3.4%)	9 (8.9%)	10 (0.9%)
BRACHYCENTIDAE	8 (7.6%)	20 (19.9%)	3 (2.9%)	1 (1.0%)

Table 3.64. Mean benthic macroinvertebrate densities **(#/m²)** for the Pend Oreille River. Number of samples enclosed in parenthesis.

Study site	1	2	3	4	5	6	7	8	9	10	11
APRIL	10022 (3)	•	6524 (3)	17736 (2)	28855 (3)	4608 (2)	34114 (3)	27265 (2)	31925 (3)	5809 (2)	•
JUNE	2499 (2)	19340 (1)	7215 (3)	12110 (2)	10331 (3)	7708 (3)	2181 (3)	6047 (3)	5402 (3)	7134 (3)	5993 (3)
JULY	2533 (1)	15724 (3)	3854 (3)	7171 (3)	9976 (3)	3774 (3)	29624 (1)	692 (3)	2642 (3)	567 (3)	2046 (2)
SEPTEMBER	4342 (2)	378 (2)	1606 (2)	8367 (3)	6479 (3)	7423 (3)	8808 (3)	9274 (3)	3899 (3)	3775 (3)	16001 (3)
OCTOBER	3145 (3)	1321 (3)	6416 (3)	8492 (3)	6856 (3)	5031 (3)	11446 (3)	6604 (3)	2894 (3)	5597 (3)	•
ANNUAL MEAN	4508 (11)	9191 (9)	5124 (14)	10775 (13)	12499 (15)	5709 (14)	17234 (13)	9976 (14)	9353 (15)	4576 (14)	8013 (10)

• No samples collected.

Table 3.65. Annual mean number of benthic macroinvertebrate per square meter at each study site in the Pend Oreille River, WA.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	TOTAL	%
TRICHOPTERA													
Brachycentridae		352.2				25.2	125 8		100.6			55	0 7
Hydroptilidae	10.4		86.2	141 4	211.4	163.6	63.0	43.8	93.8	139.8	50.4	91	1.1
Leptoceridae	12.6		71.2	125.8	699 6	31.2	102.4	125.8	348.2	36.4		141	1.7
Polycentropidae					10 4	10.4	62 6		10 4			9	0 1
Limnephilidae					77.2	528.2			10 4			56	0 7
T. pupae		12 6		12.6								2	0.02
EPHEMEROPTERA													
Baetidae		490.6		37.8	25 2			75.4	25 2	25.2		62	0.7
Ephemerellidae		88.0										9	0 1
Leptophlebidae		50.4										5	0.05
Tricorythidae		12.6	64.6	78.6	50 4	75.6	25 2	69.0	172 0	69.8	177 8	72	0.9
PLECOPTERA													
Chloroperlidae	12.6	25 2		12.6			25.2					7	0.08
COLEOPTERA													
Elmidae		445.2	125.0	363.2	616 4	345.4	1411.2	248.0	71.0	266.0	25 2	356	4 3
Chrysomelidae			10.4									1	0 01
DIPTERA													
Chironomidae larvae	413 6	993.6	1953.4	3527.2	3658.4	1041.6	7459.4	3512.6	4148 2	1529.0	1410 0	2695	32 3
Chironomidae pupae	48.2	37.8	60.8	78 2	244.0	25 2	260.4	481 4	489.6	26.0		159	1 9
Ceratopogonidae	37.8		145.8	212.6	119.4	143.0	119.4	25.2	73.4	182 2	73 0	103	1.2
Empididae			10 4		50.2	113.2		50.2				20	0.2
Tabanidae											25 2	2	0.02
Dolichopodidae								15.6				1	0 01
Simuliidae		12.6										1	0.01
Tipulidae		25.2		15.6	73.0	12.6	162 8	403.2	73.0	20.8	0 6	72	0 9
ODONATA		37.8					20.8	12.6	35.6		10.4	11	0.1
HYDRACARINA	40.8		95.8	156.8	148 6	37.8	295.2	122.4	94.2	128.8	106.6	112	1.3
CLADOCERA													
Daphnidae					60.8		48.2	250.0	20.8		25 2	37	0 4
Chydoridae						25.2						2	0 02
COPEPODA													
Harpacticoid	63.0	37 8	20 8	15.6					12.6	10.4		15	0.2
Cyclopoid				62.6		25.2	41.6	62 6				18	0 2
Calanoid					10.4							1	0.01
AMPHIPODA			62.6	53 4	114.6	25.2	118.8	410.4	479.0	736.2	234.4	203	2.4
OSTRACODA	231.4		116.8	375.0	117.0	91.0	138.4		54.2	31.2		105	1 3
OLIGOCHAETA	3253.4	4542.2	1659.2	3064 6	3455.6	1513.8	4311.8	2167 6	1883.0	748.6	1466 6	2593	31 1
HIRUDINEA	10.4				106.6	20.8	50 4		20.8			19	0 2
TURBELLARIA													
Planariidae			31 2	251.6	23.0	166.6	35.6	50.4	244.0	23.0	37.8	79	0.9
NEMATODA	176.2	125.8	168.8	685.8	627.4	120.0	71.2		23 0	31.2	247.2	207	2.5
MOLLUSCA													
Lymnaeidae		37.8	12 6	15.6		31.2	152.4	15.6		123 6	10.4	36	0.4
Physidae													
Planorbidae	46.8		67.8	147 6	422.4	415 6	691.4	72.0	146.6	286.8	496.4	254	3.0
BIVALVIA													
Sphaeriidae	151 0	25 2	342 4	825.4	1495.6	402 2	1405.8	1265 8	697.6	151.0	410 8	652	7 8
TERRESTRIALS			20 8	500 0		319.0			25.2	10 4		80	1 0
TOTAL	4508	7354	5124	10763	12422	5709	17196	9930	9353	4576	4808	8343	

Table 3.66. Benthic macroinvertebrate densities (#/m^2) for selected sloughs on the Pend Oreille River. Number of samples enclosed in parentheses.

Study site	CCA (3A)	OLD DIKE (4A)	POW WOW (5A)	GOOSE ISL.(6A)
APRIL	4079 (3)	*	13974 (4)	32134 (1)
JUNE	17267 (4)	7721 (3)	3901 (3)	3801 (3)
JUNE	5285 (2)	3523 (3)	12656 (3)	1453 (2)
SEPTEMBER	3993 (3)	4027 (3)	22266 (3)	5569 (3)
OCTOBER	5757 (2)	10380 (2)	13972 (2)	4438 (2)
ANNUAL MEAN	7276 (14)	6415 (11)	13354 (15)	12095 (11)

* No samples collected.

(Table 3.67). Chironomidae larvae was next, followed by Planorbidae, Ceratopogonidae, and Nematoda.

Shannon-Weiner diversity for benthic macroinvertebrates was 3.072 for the river sites and 2.968 for slough sites (Table 3.68).

The mean monthly densities for benthic macroinvertebrates in the river an sloughs can be found in Appendix E, Tables E.9 through E.17.

3.4.3 ZOOPLANKTON

3.4.3.1 STANDING CROP

A total of 31 species from 26 different genera were identified from the Pend Oreille River during 1988 (Table 3.69). Nine species were Cladocera, four were Copepoda and eighteen were Rotifera.

Seasonal fluctuations in zooplankton density or standing crop from the river are shown in Fig. 3.1. In April, the mean density was 97 organisms per liter. In June, density rose to 326 organisms per liter then declined to 45 organisms per liter in October. Mean zooplankton density for the Pend Oreille River in 1988 was 122 organisms per liter.

Crustacean zooplankton consisted of three major taxonomic groups: rotifers, cladocerans and copepods. The seasonal change in percent composition of rotifers, cladocerans and copepods for 1988 is shown in Fig. 3.1. In April, rotifers were predominant at 72.0 percent, with copepods at 26.0 percent and cladocerans at 2.0 percent. Rotifers still predominated in June at 85 percent, with copepods composing 10.2 percent and copepods at 4.6 percent. In July, copepods rose to 46.7 percent, with rotifers declining to 39.0 percent and cladocerans increasing to 14.0 percent. Copepods also predominated in September at 45.0 percent, with rotifers composing 43.0 percent and cladocerans 12.0 percent. In October, rotifers predominated at 51 .O percent, while copepods and cladocerans made up 32 percent and 17 percent respectively. Overall zooplankton composition for the Pend Oreille River during 1988 consisted of 58 percent rotifers, 32 percent copepods and 10 percent cladocerans.

Fig. 3.2 shows seasonal fluctuations in density at each site for 1988. Data for each site (I-11) during each sample period (April, June, July, September and October) are contained in Appendix F.

Table 3.67. Mean number and percent composition of macroinvertebrates per square meter in sloughs of the Pend Oreille River, WA.

	CCA SLOUGH		OLD DIKE SLOUGH		POW WOW SLOUGH		GOOSE ISLAND SLOUGH	
	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%	TOTAL MEAN	%
TRICHOPTERA								
Hydroptilidae	42	0.6	79	1.2	98	0.8	257	2.1
Leptoceridae			16	0.2	66	0.6	50	0.4
T. pupae			47	0.7				
EPHEMEROPTERA								
Baetidae	10	0.1					25	0.2
Tricorythidae			16	0.2	104	0.9		
COLEOPTERA								
Elmidae larvae					259	2.2	113	0.9
DIPTERA								
Chironomidae larvae	792	10.9	1966	30.6	2908	24.8	1611	13.3
Chironomidae pupae	52	0.7			90	0.8	350	2.9
Ceratopogonidae	355	4.9	315	4.9	1093	9.3	392	3.2
Empididae					25	0.2		
Simuliidae					8	0.07		
Tipulidae					20	0.2	52	0.4
ODONATA	83	1.1	16	0.2	35	0.3		
HYDRACARINA			291	4.5	76	0.6	345	2.8
AMPHIPODA	38	0.5	134	2.1	151	1.3	134	1.1
CLADOCERA							21	0.2
OSTRACODA	48	0.7	32	0.5	175	1.5	774	6.4
OLIGOCHAETA	4577	62.9	1384	21.6	5654	34.4	4588	37.9
NEMATODA	368	5.1	79	1.2	921	7.8	127	1.1
TURBELLARIA								
Planariidae	620	8.5			25	0.2	524	4.3
HIRUDINEA			16	0.2	8	0.07	135	1.1
MOLLUSCA								
Planorbidae	121	1.7	1848	28.8	938	8.0	1875	15.5
Lymnaeidae			108	1.7	168	1.4	48	0.4
BIVALVIA								
Sphaeriidae	69	1.0	55	0.9	511	4.4	234	1.9
TERRESTRIALS	99	1.4			13	0.1		
TOTAL	**7276**		**6415**		**13354**		**12095**	

Table 3.68. Shannon-Weiner diversity indices for benthic macroinvertebrates in the river and sloughs.

PEND OREILLE SLOUGHS		PEND OREILLE RIVER	
# Taxa	27	# Taxa	38
# Individuals	9383	# Individuals	8343
Simpson Div.	.786	Simpson Div.	.787
Shannon Div.	2.968	Shannon Div.	3.072
D-max	4.754	D-max	5.247

Table 3.69. Zooplankton species observed in the Pend Oreille River, 1988.

Phylum Arthropoda
- Class Crustacea
  - Subclass Brachiopoda
    - Order Cladocera
      - Family Daphnidae
        1. *Daphnia galeata mendotae*
        2. *Daphnia retrocurva*
        3. *Ceriodaphnia lacustris*
      - Family Chydoridae
        4. *Chydorus sphaericus*
        5. *Camptocercus rectirostris*
        6. *Graptoleberis testudinaria*
      - Family Sididae
        7. *Diaphanosoma leuchtenbergianum*
      - Family Bosminidae
        8. *Bosmina longirostris*
      - Family Leptodoriidae
        9. *Leptodora kindtii*
  - Subclass Copepoda
    - Order Eucopepoda
      - Suborder Calanoida
        - Family Diaptomidae
          10. *Diaptomus ashlandi*
        - Family Temoridae
          11. *Epischura lacustris*
      - Suborder Cyclopoida
        - Family Cyclopidae
          12. *Cyclops bicuspidatus thomasi*
      - Suborder Harpacticoida
        - Family Canthocamptidae
          13. *Bryocampus* sp.

Phylum Rotifera
- Class Monogononta
  - Order Foscalariacea
    14. *Filinia terminalis*
    15. *Testudinella patina*
    16. *Conochilus unicornis*
  - Order Collothecaceae
    17. *Collotheca pellagica*
  - Order Ploima
    18. *Asplanchna herricki*
    19. *Asplanchna priodonta*
    20. *Euchlanis dilatata*
    21. *Kellicottia longispina*
    22. *Keratella cochlearis*
    23. *Keratella quadrata*
    24. *Lecane luna*
    25. *Monostyla lunaris*
    26. *Notholca laurentiae*
    27. *Platyias patulus*
    28. *Polyarthra dolichoptera*
    29. *Polyarthra vulgaris*
    30. *Trichocerca cylindrica*
    31. *Trichocerca lota*

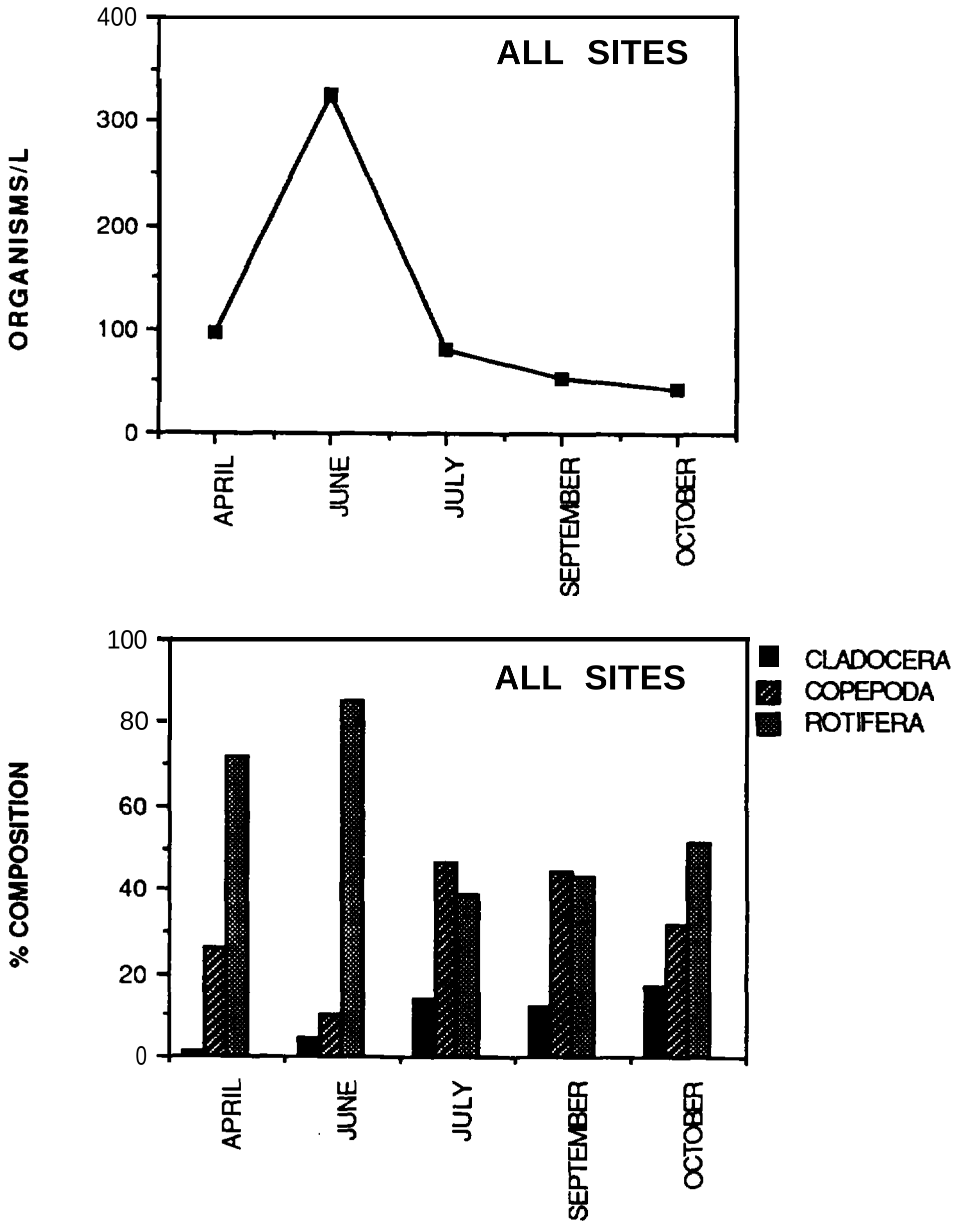

Figure 3.1. Seasonal fluctuation in total density (organisms per liter) and percent composition of major zooplankton taxa over all sites in the Pend Oreille River, WA 1988.

Seasonal trends in densities at each site were very similar to each other and to the overall trend in the river. Densities at each site were low in April, ranging from a low of 55 organisms per liter at site 11, to 152 organisms per liter at site 1, with a mean density of 97 organisms per liter. In June, densities rose dramatically at each site, ranging from a low of 161 organisms per liter at site 11, to 507 organisms per liter at site 2, with a mean density of 326 organisms per liter. Densities declined at each site in July, ranging from 52 organisms per liter at site 7 to 154 organisms per liter at site 1. The mean density for July was 87 organisms per liter. In September, all but one site declined in density. Density values ranged from 20 organisms per liter at site 11, to 96 organisms per liter at site 1, with a mean density of 54 organisms per liter. In October, most sites had slightly lower densities, ranging from 35 organisms per liter at site 5, to 75 organisms per liter at site 11, with a mean density of 45 organisms per liter.

Mean density values for each site and each sample period are contained in Table 3.70. Overall mean density during the sampling period from April to October, 1988 ranged from 74 organisms per liter at site 11, to 233 organisms per liter at site 3, with an overall mean density for the entire study area of 122 organisms per liter.

Graphs with percent composition of the major zooplankton taxa: rotifers, cladocerans and copepods for each site during each sampling period are contained in Fig. 3.3. The data from which these graphs were constructed can be found in Appendix F. In April, rotifers predominated at every site, ranging from 59.3 percent at site 11, to 81.9 percent at site 2, with a mean of 72 percent rotifers for the study area. The major rotifers species present at this time were *Kellicottia longispina, Kera tella cochlearis, Kera tella quadrata,* and *Notholca laurentiae* (Appendix F). Copepods ranged from 16 percent at site 2, to 37.9 percent at site 11, with a mean copepod composition of 26 percent overall. Major copepod species were *Diaptomus ashlandi* and *Cyclops bicuspidatus thomasi,* with nauplii accounting for over half of the copepod composition. Cladocerans made up a minor percentage of the zooplankton in April ranging from 0 percent at site 9 to 6.6 percent at site 3, with a river mean of 1.5 percent. *Chydorus sphaericus* accounted for most of the zooplankton present at this time.

In June, rotifers ranged from 75.1 percent at site 11, to 94 percent at site 1, with a mean of 85 percent all sites combined. The

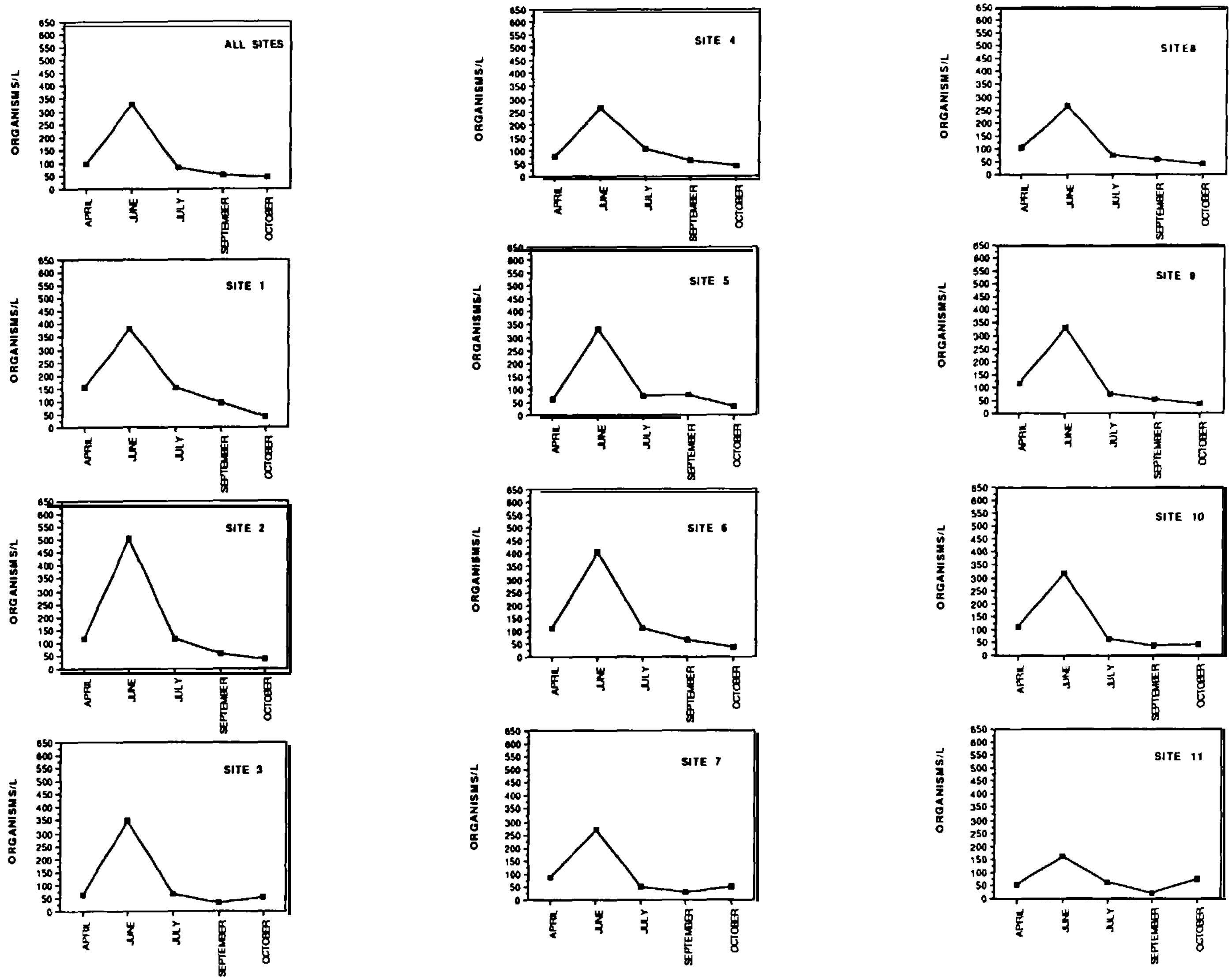

Figure 3.2. Seasonal fluctuations in density (organisms/L) for each site in the Pend Oreille River, 1988

Table 3.70. Mean densities (organisms per liter) of zooplankton samples from the Pend Oreille River, 1988, by sample site and by sample date.

Months	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Month mean
April	152.32	117.42	62.56	80.50	63.08	110.78	88.92	104.42	117.74	112.70	55.10	96.80
June	379.61	506.92	349.35	264.24	331.74	405.30	270.30	264.04	330.60	318.75	160.74	325.60
July	153.64	114.26	64.86	109.65	75.90	110.86	52.53	75.98	73.66	60.44	60.96	86.60
September	95.70	59.28	33.21	63.92	79.46	65.52	29.50	57.32	55.64	35.70	20.40	54.20
October	40.94	36.10	54.05	41.72	35.03	37.20	49.35	41.58	36.80	43.00	74.58	44.60
Site mean	164.40	166.80	232.80	112.00	117.00	145.90	98.12	75.98	122.90	114.12	74.40	121.60

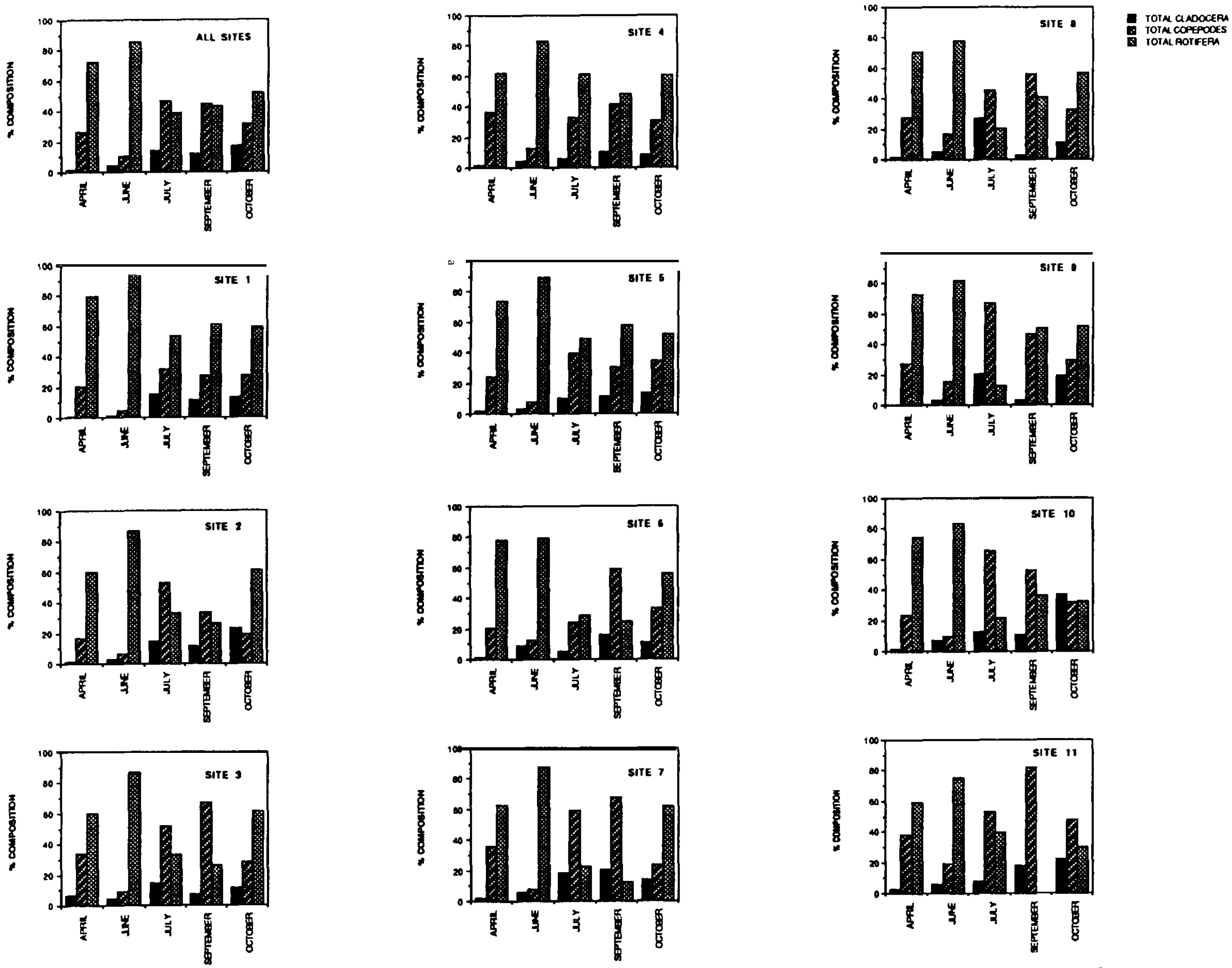

Figure 3.3. Seasonal fluctuations in zooplankton composition for each study site.

major rotifer species were *Kellicottia longispina, Keratella cochlearis, Keratella quadrata, Polyarthra dolichoptera* and *Polyarthra vulgaris.* *Keratella cochlearis* was the most numerous rotifer. Copepod composition ranged from 4.6 percent at site 1, to 19.1 percent at station 11, with a mean copepod composition of 10.2 percent for the study area. *Diaptomus ashlandi* and *Cyclops bicuspidatus thomasi* were the major copepod species with nauplii representing 40 percent of the copepod population. Cladocerans were still a minor component, with a range of 1.5 percent at site 1, to 8.6 at site 6, with an overall mean of 4.6 percent. The predominant cladoceran species was *Bosmina longirostris.*

In July, rotifer overall mean composition declined to 39 percent, ranging from 12.6 percent at site 9, to 53.6 percent at site 1. *Keratella cochlearis* was the most numerous rotifer, followed by *Kellicottia longispina* and *Polyarthra vulgaris.* Copepods dominated at most sites, ranging from 33 percent at site 4, to 66.9 percent at site 9, with a mean of 46.7 percent overall. Major cladoceran species were *Daphnia galeata mendotae, Daphnia retrocurva,* and *Bosmina longirostris.*

In September, rotifer composition varied from 0 percent at site 11, to 61.4 percent at site 1, with a mean of 43.2 percent overall. *Conochilus unicornis* was the dominant rotifer, comprising 88 percent of the population. Copepod composition varied from 27.2 percent at site 1, to 82.4 percent at site 11, with an overall mean of 44.9 percent. Nauplii made up over half the copepod community with copepodids representing 38 percent. *Diaptomus ashlandi* was the major copepod species. Cladoceran composition varied from 2.7 percent at site 8, to 20.3 percent at site 7 with an overall mean of 12.0 percent. *Ceriodaphnia reticulata* was the major cladoceran present.

In October, rotifer composition ranged from 30.1 percent at site 11, to 61.9 percent at site 7, with an overall mean composition of 51.3 percent. Major rotifer species were *Conochilus unicornis* and *Polyarthra vulgaris.* Copepod composition ranged from 19.1% at site 2, to 47.8 percent at site 11, with an overall mean of 31.2 percent. The major copepod species was *Diaptomus ashlandi.* Copepodids and nauplii represented approximately 30 percent each of the copepod composition. Cladocerans represented 16.9 percent of the overall composition in October, ranging from 8.1 percent at site 4, to 36.6

percent at site IO. Major cladoceran species were Daphnia *galeata mendotae* and *Bosmina longirostris.*

3.4.3.2 BIOMASS

Biomass was calculated for each of seven major cladoceran species: *Daphnia galeata mendotae, Daphnia retrocurva, Ceriodaphnia reticulata, Bosmina longirostris, Chydorus sphaericus, Diaphanosoma leuchtenbergianum* and *Leptodora kindtii.* Seasonal fluctuation in total biomass of all the cladocerans is shown in Fig. 3.4. In April, biomass was lowest at 5.8 micrograms per liter. The total number of cladocerans per liter was also lowest at this time. In June, biomass increased to 20.7 micrograms per liter, as did the total number of cladocerans per liter. In July, biomass increased to 53.3 micrograms per liter, though the mean number of cladocerans per liter decreased. In September, biomass decreased to 12.7 micrograms per liter, with numbers of cladocerans per liter also decreasing. In October, biomass slightly increased to 22.1 micrograms per liter and numbers of cladocerans per liter also increased slightly.

Percent composition in biomass of major cladoceran species is shown in Fig. 3.4. In April, biomass composition consisted of 98.5 percent *Chydorus sphaericus.* In June, *Bosmina longirostris* made up 76.4 percent of the biomass, with *Daphnia galeata mendotae* at 13.1 percent and *Daphnia retrocurva* at 9.5 percent. In July, biomass was dominated by *Daphnia* galeata *mendotae* at 62.5 percent, with *Daphnia retrocurva* at 31 .O percent and Bosmina longirostris drastically declining to 4.5 percent. Though biomass had increased in July, the total number of cladocerans per liter had decreased. This was due to the major cladoceran components in June and July. Though June densities were higher, *Bosmina longirostris* was the dominant zooplankter; the mean weight of *Bosmina longirostris* was 1.2 micrograms. In July, densities were lower, but *Daphnia galeata* mendotae dominated the cladoceran community; the mean weight of *Daphnia galeata* mendotae was 5.24 micrograms, over four times the weight of *Bosmina longirostris.* The increased weight per organism of the dominant zooplankter contributed to the overall increase in July biomass.

In September, *Ceriodaphnia reticulata* accounted for 32 percent of the cladoceran biomass, followed by *Diaphanosoma leuchtenbergianum* at 31 percent, Daphnia galeata mendotae at 27 percent and *Leptodora kindtii* at 2.8 percent (Fig. 3.4). In October,

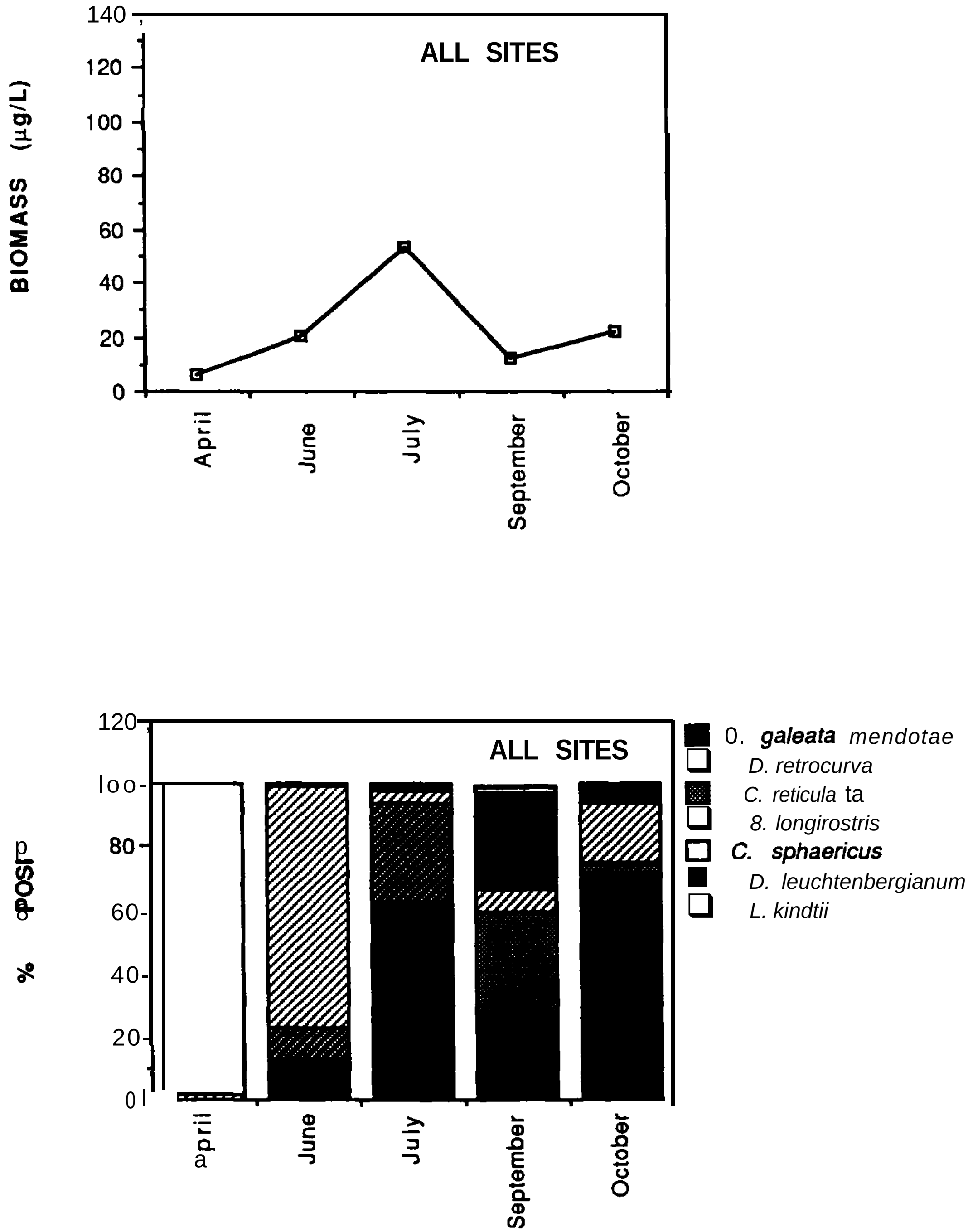

Figure 3.4. Seasonal fluctuation in cladoceran biomass (µg/L) and percent composition in biomass of major cladoceranspecies in the Pend Oreille River, 1988

Daphnia galeata mendotae again dominated cladoceran biomass at 72.2 percent, followed by *Bosmina longirostris* at 19.5 percent, *Diaphanosoma leuchtenbergianum* at 5.8 percent and *Ceriodaphnia reticulata* at 2.5 percent (Fig. 3.4). The increase in *Daphnia galeata mendotae* biomass parallels the increase in densities of this cladoceran in October. *Daphnia galeata mendotae* appeared to have a midsummer and fall bloom in the Pend Oreille River in 1988.

Fig. 3.5 shows seasonal changes in biomass at each site (l-l 1) in the Pend Oreille River. Data are found in Appendix F. Most sites had low biomass values ranging from 0 micrograms per liter at site 9, to 9.85 micrograms per liter at site 7, except site 3 at 36.0 micrograms per liter. The mean biomass for April was 5.8 micrograms per liter.

In June, the mean biomass rose to 20.7 micrograms per liter and most sites also increased. Biomass values ranged from 10.4 micrograms per liter at site 3, to 37.0 micrograms per liter at site 6 (Fig. 3.5).

Biomass values also increased at most sites in July, ranging from 26.0 micrograms per liter at site 4, to 138.4 micrograms per liter at site 8. Mean biomass was 53.3 micrograms per liter. Sites 8 and 9 had the highest biomass values, probably due to the greater numbers of *Daphnia galeata mendotae* found at these sites (Fig. 3.5).

In September, biomass values decreased at all sites, ranging from 3.8 micrograms per liter at site 3, to 24.4 micrograms per liter at site 6. Mean biomass was the lowest of all sampling periods at 12.7 micrograms per liter (Fig. 3.5).

The mean biomass in October was slightly higher at 22.1 micrograms per liter. Biomass values ranged from 6.7 micrograms per liter at site 4, to 44.7 micrograms per liter at site 10. Most sites increased slightly in biomass during this period, except sites 1,4 and 6 (Fig. 3.5).

Figure 3.6 shows seasonal fluctuations in cladoceran composition during the sampling periods in 1988. In April, cladoceran biomass at most sites was 100 percent *Chydorus sphaericus.* Exceptions were found at site 9 which had no biomass values, site 10 which was dominated by *Bosmina longirostris* at 67.8 percent and site 11 where *C.sphaericus* made up 80 percent of cladoceran biomass

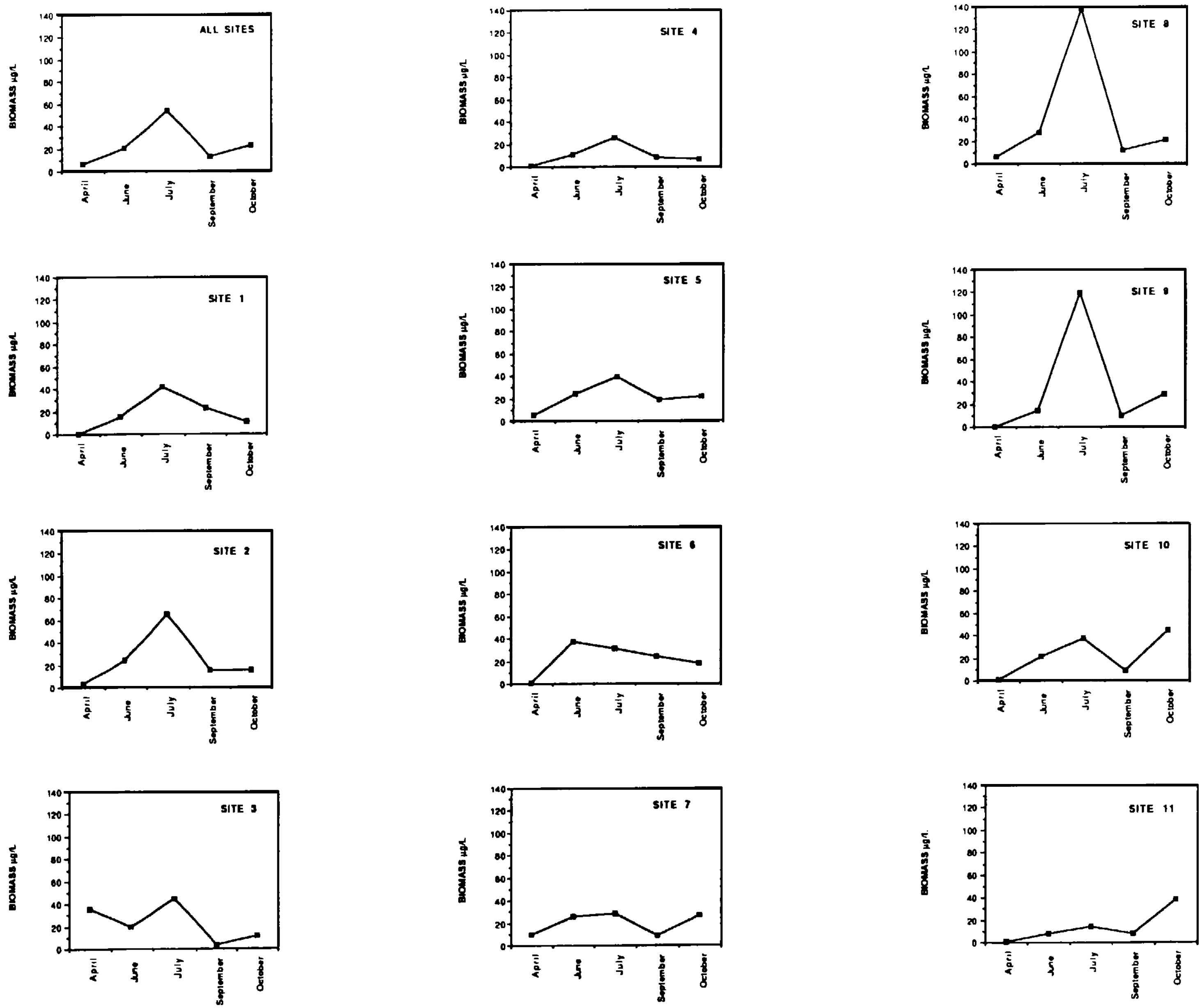

Figure 3.5. Seasonal fluctuations in biomass (µg/L) for each study site each month.

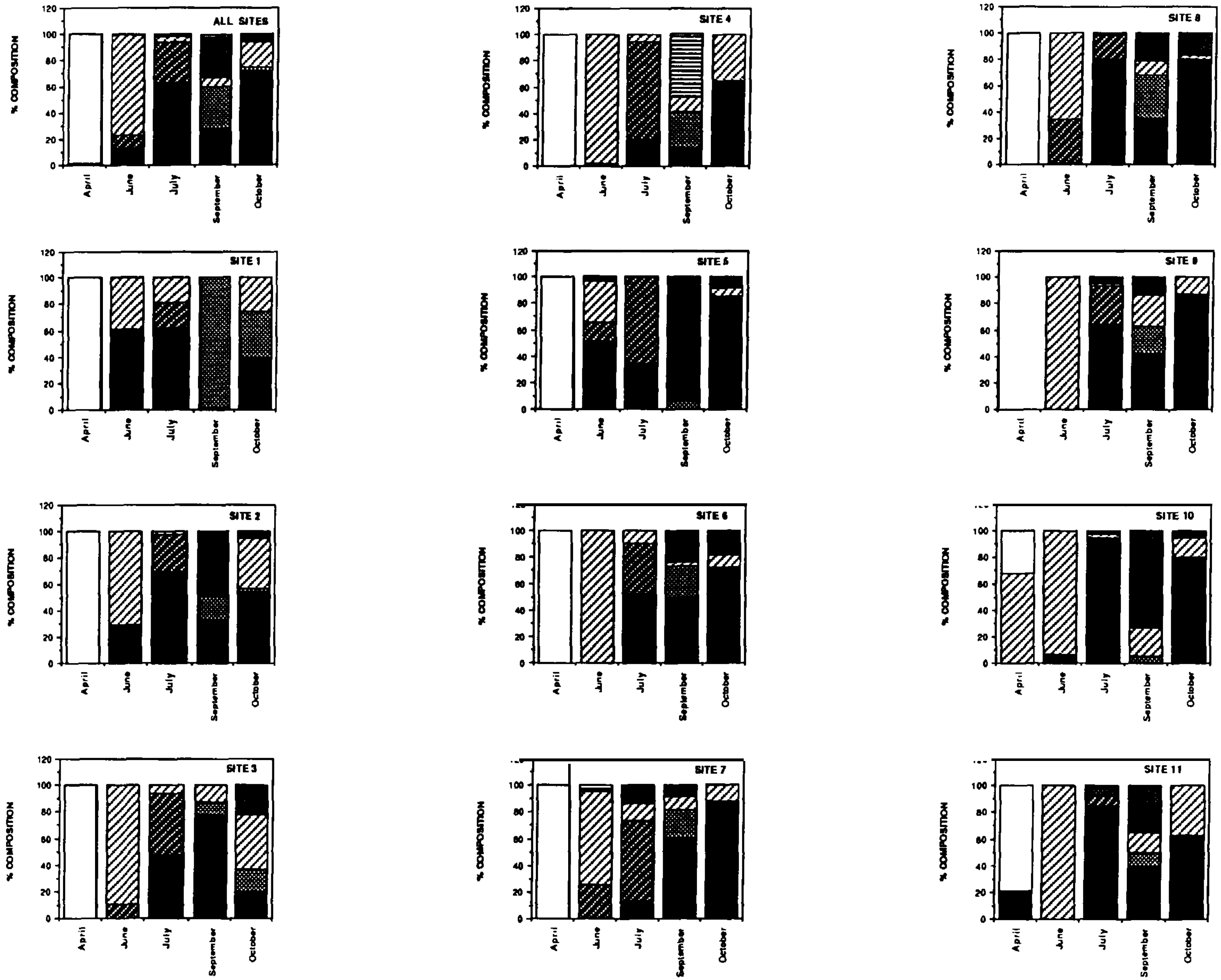

Figure 3.6. Seasonal fluctuations in percent compostion of cladoceran biomass at each site.

In June, cladoceran biomass composition varied from site to site. All sites had *Bosmina longirostris.* *Bosmina* accounted for 34.2 percent at site 5, to 100 percent at site 6. Some sites had *Daphnia galeata mendotae,* which represented from 0 at sites 3, 4, 6, 7, 8 and 9 to 61.4 percent of the biomass at site 1. Other sites had *Daphnia fetrocurva,* which accounted for 0 percent of the biomass at sites 1, 2, 6, 9, 10 and 11, to 34.5 percent of the biomass at site 8.

In July, cladoceran biomass composition was somewhat similar from site to site. *Daphnia galeata mendotae* was represented at all sites, ranging from 13.0 percent at site 7, to 94.5 percent at site 10. *Daphnia fetfocurva* was represented at all sites except site 10, ranging from 7.9 percent at site 11, to 74.4 percent at site *4. Bosmina longirostris* represented 0.6 percent of the biomass composition at site 11, to 19.1 percent at site *1. Bosmina longirostris* was not collected at site *5. Diaphanosoma leuchtenbefgianum* was a minor component at some sites, ranging from 2.2 percent at site 10, to 13.3 percent at site 7.

In September, cladoceran biomass varied greatly from site to site. *Cefiodaphnia reticulata* was represented at all sites, but varied in biomass composition from 7.2 percent at site 5, to 99.1 percent at site 1. *Bosmina longirostris* was present at most sites except 1 and 5 and represented 1.8 percent of the biomass at site 2, to 23.4 percent of the biomass at site *9. Diaphanosoma leuchtenbefgianum* was present at all sites except 1, 3 and 4. Percent composition ranged from 8.3 percent at site 7, to 92.8 percent at site 5. *Daphnia galeata mendotae* was also present at most sites, except 1, 5 and 10. Percent composition varied from 13.8 percent at site 4, to 77.8 percent at site *3. Daphnia fetfocufva* and *Leptodofa kindtii* were minor components at only one site each.

In October, cladoceran composition was somewhat more similar from site to site than September. *Daphnia* galeata *mendotae* dominated the composition at the majority of the sites, ranging from 20.3 percent at site 3, to 87.7 percent at site 7. *Bosmina longirostris* represented from 2.5 percent of the cladoceran biomass at site 8, to 41.3 percent of the biomass at site *3. Diaphanosoma leuchtenbefgianum* and *Ceriodaphnia feticulata* were minor components at most sites.

3.5 TRIBUTARY FISH FEEDING HABITS

Results of tributary fish feeding habits were based on mean annual values. For each tributary, the number percentage, weight percentage, occurrence frequency and index of relative importance for each prey item were listed. Annual means were determined for each age class of each species so that differences between age classes within a species as well as differences between species could be assessed. Electivity indices for prey items in the benthos as well as the drift were computed for each age class of each species using mean annual percentage by number values. Diet overlaps were computed using mean annual IRI values to determine intra-specific and inter-specific competition for food resources in each tributary. Results of monthly feeding habits in the tributaries are listed in Appendix G. These data include mean number and weight (± standard deviation), the number percentage, weight percentage, occurrence frequency and index of relative importance percentage for each prey item for each species of fish.

3.5.1 SKOOKUM CREEK

Stomachs were collected from 24 brown trout, 45 brook trout, and 8 cutthroat trout from Skookum Creek. Trout food items consisted of 52 invertebrate families representing 18 orders.

3.5.1 .1 BROWN TROUT

Table 3.71 lists the percent composition by number for prey items consumed by brown trout in Skookum Creek. For 0+ brown trout, Trichoptera adults had the highest numerical percent at 37.4 percent followed by Baetidae at 29.2 percent. For 1+ brown trout, Baetidae had the highest numerical percent at 39.6 percent followed by Aphididae (24.5%) and other Trichoptera (11.8%). For 2+ brown trout, Limnephilidae had the highest numerical frequency at 30.8 percent followed by Glossosomatidae (30.4%) and Formicidae (12.7%). For 3+ brown trout, Perlodidae had the highest numerical frequency at 17.1 percent followed by Brachycentridae (17.0%) and Arachnidae (16.7%). When all age classes of brown trout where combined, Baetidae had the highest numerical percent at 18.1 percent followed by Limnephilidae (12.4%) and Glossosomatidae (8.9%).

Table 3.71. Mean annual number frequencies of prey items consumed by brown trout in Skookum Creek for 1988.

	0 +	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=6	n=12	n=3	n=3	n=24
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae		5.0			1.3
Rhyacophilidae					
Limnephilidae		2.7	30.8	15.9	12.4
Brachycentridae	2.1	0.8	3.6	17.0	5.9
Glossosomatidae		7.2	30.4		8.9
Trichop. pupae					
Other[1]		11.8			3.0
Ephemeroptera (mayflies)					
Ephemerellidae	2.1	1.0			0.8
Baetidae	29.2	39.6	3.6		18.1
Heptageniidae	4.2	0.5			1.2
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	4.2	1.0			1.3
Chironomidae pupae			1.8		0.5
Simuliidae		2.2	4.5		1.7
Tipulidae					
Other[3]		0.2	1.8		0.5
Plecoptera (stoneflies)					
Perlodidae	4.2	1.1		17.1	5.6
Nemouridae					
Chloroperlidae					
Other[4]					
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae					
Elmidae adult		0.2			0.1
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	4.2	0.1	1.8		1.5
Other[9]	4.2				1.1
TOTAL	55.0	73.4	78.3	50.0	66.8

Table 3.71. (cont.)

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=24
Terrestrial invertebrates					
Trichoptera adult	37.4	1.7			7.3
Diptera (flies, midges)					
Empididae adult			9.1		2.3
Chironomidae adults					
Other adults[10]					
Coleoptera (beetles)					
Scarabaeidae					
Staphylinidae					
Carabidae					
Other[11]					
Hemiptera[12] (true bugs)					
Homoptera					
Cicadellidae					
Aphididae		24.5			6.1
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae		0.2	12.7		3.2
Other[14]					
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae				16.7	4.2
Lepidoptera					
Other [16]	8.3			33.0	10.3
Total	45.7	126.4	21.8	49.7	28.4

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Percent composition by weight for prey items consumed by brown trout in Skookum Creek are listed in Table 3.72. For 0+ brown trout, Oligochaeta had the highest weight frequency at 44.9 percent followed by Trichoptera adults (35.8%) and Ephemerellidae (8.8%). For 1+ brown trout, Ephemerellidae had the highest weight frequency at 27.5 percent followed by Oligochaeta (22.0%), and Baetidae (17.4%). For 2+ brown trout, Formicidae had the highest weight frequency at 40.9 percent followed by Oligochaeta (26.3%) and Limnephilidae (12.5%). For 3+ brown trout, Perlodidae had the highest weight frequency at 18.9 percent followed by Arachnidae (18.2%) and Limnephilidae (12.9%). For all age classes of brown trout combined, Oligochaeta had the highest weight percentage at 23.3 percent followed by Trichoptera adults (11 .O%) and Formicidae (10.4%).

Table 3.73 lists the frequency of occurrence for prey items consumed by brown trout in Skookum Creek. For 0+ brown trout, Baetidae had the highest occurrence frequency at 62.5 percent followed by Heptageniidae, Perlodidae, Gastropoda and Trichoptera adults at 25 percent each. For 1+ brown trout, Baetidae had the highest occurrence frequency at 41.7 percent followed by Simuliidae (25.0%) and Aphididae (20.9%). For 2+ brown trout, Limnephilidae and Formicidae occurred in 100 percent of stomachs. For 3+ brown trout, Limnephilidae, Perlodidae, and Arachnidae each occurred 50 percent of the time. For all age classes combined, Limnephilidae had the highest occurrence frequency at 40.6 percent followed by Baetidae (38.6%) and Formicidae (26.1%).

Table 3.74 lists the index of relative importance (IRI) for prey items consumed by brown trout in Skookum Creek. For 0+ brown trout, Trichoptera adults had the highest IRI at 28.1 percent followed by Baetidae (19.6%) and Oligochaeta (13.5%). For 1+ brown trout, Baetidae had the highest IRI at 24.6 percent followed by other Trichoptera (13.7%) and Ephemerellidae (11.3%). For 2+ brown trout, Formicidae had the highest IRI at 25.2 percent followed by Limnephilidae (22.9%) and Glossosomatidae (8.9%). For 3+ brown trout, Perlodidae had the highest IRI at 17.1 percent followed by Brachycentridae and Arachnidae at 17.0 percent each. For all age classes combined, Baetidae had the highest IRI at 12.4 percent followed by Limnephilidae (10.3%), and Trichoptera adults (8.2%).

Table 3.72. Mean annual weight frequencies of prey items consumed by brown trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=24
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae		8.6			2.2
Rhyacophilidae					
Limnephilidae		1.0	12.5	12.9	6.6
Brachycentridae	0.7	0.1	2.8	1.0	1.2
Glossosomatidae		3.9	9.5		3.4
Trichop. pupae					
Other[1]		2.3			0.6
Ephemeroptera (mayflies)					
Ephemerellidae	8.8	27.5			9.1
Baetidae	4.4	17.4	1.3		5.8
Heptageniidae	1.0	<0.1			0.3
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	0.7	0.5			0.3
Chironomidae pupae			1.5		0.4
Simuliidae		3.3	1.9		1.3
Tipulidae					
Other3		0.2	1.5		0.5
Plecoptera (stoneflies)					
Perlodidae	2.0	0.5		10.9	5.4
Nemouridae					
Chloroperlidae					
Other4					
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae					
Elmidae adult		0.7			0.2
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	44.9	22.0	26.3		23.3
Other[9]	1.0				0.3
TOTAL	**63.5**	**88.1**	**57.3**	**32.8**	**60.9**

Table 3.72. (cont.)

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=24
Terrestrial invertebrates					
Trichoptera adult	35.8	8.1			11.0
Diptera (flies, midges)					
Empididae adult			1.9		0.5
Chironomidae adults					
Other adults[10]					
Coleoptera (beetles)					
Scarabaeidae					
Staphylinidae					
Carabidae					
Other[11]					
Hemiptera[12] (true bugs)					
Homoptera					
Cicadellidae					
Aphididae		3.4			0.9
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae		0.5	40.9		10.4
Other[14]					
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae				18.2	4.6
Lepidoptera					
Other [16]	1.0			49.0	12.6
Total	136.8	112.0	142.8	167.2	140.0

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae. Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.73. Mean annual occurrence frequencies of prey items consumed by brown trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=24
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae		12.5			3.1
Rhyacophilidae					
Limnephilidae		12.5	100.0	50.0	40.6
Brachycentridae	12.5	12.5	50.0	25.0	21.9
Glossosomatidae		20.8	50.0		17.7
Trichop. pupae					
Other[1]		33.4			8.4
Ephemeroptera (mayflies)					
Ephemerellidae	12.5	16.7			7.3
Baetidae	62.5	41.7	50.0		38.6
Heptageniidae	25.0	8.3			8.3
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	12.5	16.7			7.3
Chironomidae pupae			50.0		12.5
Simuliidae		25.0	25.0		12.5
Tipulidae					
Other[3]		2.1	25.0		6.8
Plecoptera (stoneflies)					
Perlodidae	25.0	8.3		50.0	20.8
Nemouridae					
Chloroperlidae					
Other[4]					
Gastropoda[5] (snails)	25.0	8.3	50.0		20.8
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae					
Elmidae adult		4.2			1.1
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)					
Other[9]	25.0				6.3

Table 3.73. (cont.)

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=24
Terrestrial invertebrates					
Trichoptera adult	25.0	16.7			10.4
Diptera (flies, midges)					
Empididae adult			25.0		6.3
Chironomidae adults					
Other adults[10]					
Coleoptera (beetles)					
Scarabaeidae					
Staphylinidae					
Carabidae					
Other[11]					
Hemiptera[12] (true bugs)					
Homoptera					
Cicadellidae					
Aphididae		20.9			5.2
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae		4.2	100.0		26.1
Other[14]					
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae				50.0	12.5
Lepidoptera					
Other [16]	12.5			12.5	6.3

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.74. Mean annual index of relative importance (IRI) of prey items consumed by brown trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=6	1 + n=12	2 + n=3	3 + n=3	All ages n=
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae		3.9			1.0
Rhyacophilidae					
Limnephilidae		2.4	22.9	15.9	10.3
Brachycentridae	4.4	2.7	5.7	17.0	7.5
Glossosomatidae		4.8	8.9		3.4
Trichop. pupae					
Other[1]		13.7			3.4
Ephemeroptera (mayflies)					
Ephemerellidae	6.7	11.3			4.5
Baetidae	19.6	24.6	5.5		12.4
Heptageniidae	5.5	1.3			1.7
Other[2]		0.7	5.4		1.6
Diptera (flies, midges)					
Chironomidae larvae	5.1	1.5			1.7
Chironomidae pupae			5.4		1.4
Simuliidae		7.5	6.3		3.5
Tipulidae					
Other[3]					
Plecoptera (stoneflies)					
Perlodidae	5.5	1.5		17.1	6.0
Nemouridae					
Chloroperlidae					
Other[4]					
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae					
Elmidae adult		0.8			0.2
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	13.5	7.0	7.9		7.1
Other[9]	5.5				1.4
TOTAL	**65.8**	**81.7**	**68.0**	**50.0**	**66.7**

Table 3.74. (cont.)

	0 +	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=6	n=12	n=3	n=3	n=
Terrestrial invertebrates					
Trichoptera adult	28.1	4.6			8.2
Diptera (flies, midges)					
Empididae adult		0.7	7.2		2.0
Chironomidae adults					
Other adults[10]					
Coleoptera (beetles)					
Scarabaeidae					
Staphylinidae					
Carabidae					
Other[11]					
Hemiptera[12] (true bugs)					
Homoptera					
Cicadellidae					
Aphididae		10.9			2.7
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae		0.7	25.2		6.5
Other[14]					
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae				17.0	4.3
Lepidoptera					
Other [16]	6.3			33.0	9.9
Total	**34.4**	**16.9**	**32.4**	**50.0**	**33.6**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae. Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

3.5.1.2 BROOK TROUT

Table 3.75 presents the numerical percentages for prey items consumed by brook trout in Skookum Creek. For 0+ brook trout, Chironomidae larvae had the highest numerical frequency at 28.7 percent followed by Baetidae (17.4%) and Empididae adults (13.2%). For 1+ brook trout, Hemiptera had the highest numerical precentage at 17.4 percent followed by other Diptera adults (16.6%) and Aphididae (7.0%). For 2+ brook trout, Trichoptera pupae had the highest numerical frequency at 27.5 percent followed by Ephemerellidae (9.8%) and Limnephilidae (9.2%). For all age classes combined, Chironomidae larvae had the highest numerical frequency at 12.1 percent followed by Trichoptera pupae (9.8%) and Baetidae **(7.8%).**

Weight percentages of prey organisms consumed by brook trout in Skookum Creek are listed in Table 3.76. For 0+ brook trout, Ephemerellidae had the highest weight frequency at 23.8 percent followed by Empididae adult (19.7%) and Trichoptera adult (16.3%). For 1+ brook trout, Diptera adults had the highest weight percentage at 28.1 percent followed by Formicidae (18.5%) and Ephemerellidae (9.8%). For 2+ brook trout, Trichoptera pupae had the highest weight frequency at 29.7 percent followed by Ephemerellidae (10.3%) and Limnephilidae (8.4%). For all age classes combined, Ephemerellidae had the highest weight frequency at 14.6 percent followed by Trichoptera pupae (10.8%) and Diptera adults (9.9%).

Table 3.77 lists occurrence frequencies for prey organisms consumed by brook trout in Skookum Creek. For 0+ brook trout, Chironomidae larvae had the highest occurrence frequency at 46.9 percent followed by Chironomidae pupae (37.5%) and Baetidae (26.1%). For 1+ brook trout, Hemiptera had the highest occurrence frequency at 41.7 percent followed by Baetidae (23.3%) and Rhyacophilidae and Limneplilidae at 21.9 percent each. For 2+ brook trout, Trichoptera pupae had the highest occurrence frequency at 33.3 percent followed by Limnephilidae (26.7%) and Formicidae (21.7%). For all age classes combined, Chironomidae larvae had the highest occurrence frequency at 24.4 percent followed by Baetidae (23.1%) and Hemiptera (19.5%).

Table 3.78 presents index of relative importance (IRI) for prey items consumed by brook trout in Skookum Creek. For 0+ brook trout, Chironomidae larvae had the highest IRI at 15.5 percent followed by Chironomidae pupae (11.2%) and Baetidae (10.6%). For

Table 3.75. Mean annual number frequencies of prey items consumed by brook trout in Skookum Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=18	n=15	n=12	n=45
Aquatic organisms				
Trichoptera (caddisflies)				
Hydropsychidae				
Rhyacophilidae	1.5	6.1	1.2	2.9
Limnephilidae	2.0	5.9	9.2	5.7
Brachycentridae	0.6	1.6	0.3	0.8
Glossosomatidae				
Trichop. pupae		1.9	27.5	9.8
Other[1]			0.3	0.1
Ephemeroptera (mayflies)				
Ephemerellidae	3.5	5.4	9.8	6.2
Baetidae	17.4	3.6	2.5	7.8
Heptageniidae	2.0	1.9	0.3	1.4
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	28.7	4.8	3.0	12.1
Chironomidae pupae	9.8	0.8		3.5
Simuliidae		0.7	0.3	0.3
Tipulidae		0.7		0.2
Other[3]	1.0	1.0	0.6	0.8
Plecoptera (stoneflies)				
Perlodidae	0.2			<0.1
Nemouridae			2.0	0.7
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		1.2		0.4
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult		4.1		1.4
Other[6]	3.8			1.3
Hemiptera[7] (true bug)		17.4	2.0	6.5
Oligochaeta[8] (worms)		0.3		
Other[9]	2.2		22.5	8.2
TOTAL	72.7	57.4	81.5	70.1

Table 3.75. **(cont.)**

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Terrestrial invertebrates				
Trichoptera adult	2.4		0.5	1.0
Diptera (flies, midges)				
Empididae adult	13.2	4.2		5.8
Chironomidae adults		4.2		1.4
Other adults[10]	3.3	16.6	0.5	6.8
Coleoptera (beetles)				
Scarabaeidae			0.3	0.1
Staphylinidae	0.1			<0.1
Carabidae			0.5	0.2
Other[11]	0.1	1.1	0.4	0.5
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae	0.6			0.2
Aphididae	2.4	7.0		3.1
Cercopidae				
Other[13]	2.0	0.3		0.8
Hymenoptera (bees, wasps, ants)				
Formicidae	1.2	5.7	3.3	3.4
Other[14]	0.2	0.8	0.3	0.4
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnida	1.7	0.3	1.1	1.0
Lepidoptera		0.3	0.3	0.2
Other[16]		0.7	11.1	3.9
Total	**27.2**	**41.2**	**18.3**	**28.8**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.76. Mean annual weight frequencies of prey items consumed by brook trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae				
Rhyacophilidae	0.6	2.7	0.8	1.4
Limnephilidae	4.4	2.2	8.4	5.0
Brachycentridae	0.1	0.4	0.6	0.3
Glossosomatidae				
Trichop. pupae		2.6	29.7	10.8
Other[1]			0.4	0.1
Ephemeroptera (mayflies)				
Ephemerellidae	23.8	9.8	10.3	14.6
Baetidae	0.1	2.0	1.2	1.1
Heptageniidae	8.1	1.2	0.8	3.4
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	5.5	0.5	0.5	2.2
Chironomidae pupae	3.1	0.6	0.3	1.3
Simuliidae		0.4	<0.1	0.1
Tipulidae		0.7		0.2
Other[3]	4.4	0.1	1.1	1.9
Plecoptera (stoneflies)				
Perlodidae	0.1			<0.1
Nemouridae			0.7	0.2
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		4.0	0.3	1.4
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult		0.1		<0.1
Other[6]	0.6			0.2
Hemiptera[7] (true bug)		8.9	2.1	3.7
Oligochaeta[8] (worms)		6.9		2.3
Other[9]	6.3	0.4	28.4	11.7
TOTAL	**57.1**	**43.5**	**83.4**	**61.7**

Table 3.76. (cont.)

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Terrestrial invertebrates				
Trichoptera adult	16.3		0.7	5.7
Diptera (flies, midges)				
Empididae adult	19.7	<0.1		6.6
Chironomidae adults		<0.1		<0.1
Other adults[10]	1.0	28.1	0.7	9.9
Coleoptera (beetles)				
Scarabaeidae			0.5	0.2
Staphylinidae	0.1			<0.1
Carabidae			0.8	0.3
Other[11]	0.1	1.4	1.3	0.6
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae	0.6			0.2
Aphididae	0.1	0.9		0.3
Cercopidae				
Other[13]	3.8	0.7		1.5
Hymenoptera (bees, wasps, ants)				
Formicidae	0.9	18.5	3.6	7.7
Other[14]	0.1	2.3	0.4	0.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	0.6	0.6	1.2	0.8
Lepidoptera		0.6	0.4	0.3
Other[16]		2.9	4.9	2.6
Total	43.3	56.0	16.5	37.9

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphiroidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae. Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobtyidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.77. Mean annual occurrence frequencies of prey items consumed by brook trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae				
Rhyacophilidae	12.5	21.9	11.7	15.1
Limnephilidae	8.3	21.9	26.7	19.0
Brachycentridae	3.1	6.7	3.3	4.4
Glossosomatidae				
Trichop. pupae		8.3	33.3	13.9
Other[1]			3.3	1.1
Ephemeroptera (mayflies)				
Ephemerellidae	11.5	14.5	11.7	12.6
Baetidae	26.1	23.3	20.0	23.1
Heptageniidae	8.3	10.0	3.3	7.2
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	46.9	18.9	7.5	24.4
Chironomidae pupae	37.5	8.3		15.3
Simuliidae		6.7	4.2	3.6
Tipulidae		6.7		2.2
Other[3]	2.8	3.3	1.1	2.8
Plecoptera (stoneflies)				
Perlodidae	3.1			1.0
Nemouridae			16.7	5.6
Chloroperlidae				
Other[4]				
Gastropoda (snails)		5.5		1.8
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult		8.3		2.8
Other[6]	12.5			4.2
Hemiptera[7] (true bug)		41.7	16.7	19.5
Oligochaeta[8] (worms)		3.3		1.1
Other[9]	5.1		9.2	4.7

Table 3.77. (cont.)

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Terrestrial invertebrates				
Trichoptera adult	6.3		3.3	3.2
Diptera (flies, midges)				
Empididae adult	21.9	8.3		10.1
Chironomidae adults		8.3		2.8
Other adults[10]	3.2	8.3	2.1	4.5
Coleoptera (beetles)				
Scarabaeidae			3.3	1.1
Staphylinidae	3.1			1.0
Carabidae		3.3		3.1
Other[11]	0.8	1.9	1.9	1.5
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae	9.4			3.1
Aphididae	15.6	4.2		6.6
Cercopidae				
Other[13]	8.4	1.7		3.4
Hymenoptera (bees, wasps, ants)				
Formicidae	6.6	18.1	21.7	15.5
Other[14]	1.0	2.8	1.1	1.0
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	9.4	3.3	6.7	6.5
Lepidoptera		3.3	3.3	2.2
Other[16]		3.9	11.1	5.0

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae. Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

1+ brook trout, Diptera adults had the highest IRI at 19.5 percent followed by Hemiptera (15.8%) and Formicidae (9.7%). For 2+ brook trout, Trichoptera pupae and Diptera adults had the highest IRI at 20.1 percent followed by Limnephilidae (7.4%). For all age classes combined, Trichoptera pupae had the highest IRI at 7.4 percent followed by Ephemerellidae (7.2%) and Chironomidae larvae (7.0%).

3.5.1.3 CUTTHROAT TROUT

Table 3.79 lists percent composition by number for prey items consumed by cutthroat trout in Skookum Creek. For 0+ cutthroat trout, Empididae adults had the highest numerical percentage at 32.7 percent followed by Chironomidae larvae (18.5%) and Chironomidae pupae (10.8%). For 1+ cutthroat trout, Empididae adults had the highest numerical frequency at 28.3 percent followed by Ephemerellidae (16.7%) and Arachnidae (11 .1%). For 2+ cutthroat trout, Empididae adults had the highest numerical frequency at 37.0 percent followed by other Diptera adults at14.8 percent and Formicidae along with other Hymenoptera at 11.1 percent each. For all age classes combined, Empididae had the highest numerical percentage at 32.7 percent followed by other Diptera adults (8.7%) and Ephemerellidae (8.6%).

Percent composition by weight for prey items consumed by cutthroat trout in Skookum Creek are listed in Table 3.80. For 0+ cutthroat trout, Empididae adults had the highest weight frequency at 40.9 percent, followed by Ephemerellidae (11.6%) and Chironomidae larvae (9.7%). For 1+ cutthroat trout, Empididae adults had the highest weight frequency at 34.9 percent, followed by Arachnidae (28.1%) and Formicidae (14.6%). For 2+ cutthroat trout, Arachnidae had the highest weight frequency at 24.8 percent followed by Empididae (22.6%) and Formicidae (16.4%). For all age classes combined, Empididae adults had the highest weight frequency at 32.8 percent followed by Arachnidae (17.6%) and Formicidae (10.3%).

Occurrence frequencies for prey items consumed by cutthroat trout in Skookum Creek are listed in Table 3.81. For 0+ cutthroat trout, highest occurrence frequency was for Chironomidae larvae at 100 percent followed by Chironomidae pupae and Ephemerellidae at 75 percent each. For 1+ cutthroat trout, Trichoptera adults, Formicidae and Arachnidae each had an occurrence frequency of 100 percent. For 2+ cutthroat trout, only a single fish was collected, so all organisms had an occurrence frequency of 100 percent. For all

Table 3.78. Mean annual index of relative importance frequencies (IRI) of prey items consumed by brook trout in Skookum Creek for 1988.

PREY ORGANISMS	0+ n=18	1+ n=15	2+ n=12	All ages n=45
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae				
Rhyacophilidae	2.9	5.1	2.3	3.4
Limnephilidae	2.8	5.1	7.4	5.1
Brachycentridae	0.6	1.1	0.6	0.7
Glossosomatidae				
Trichop. pupae		2.0	20.1	7.4
Other[1]			0.5	0.2
Ephemeroptera (mayflies)				
Ephemerellidae	10.2	5.6	5.8	7.2
Baetidae	10.6	4.0	4.9	6.5
Heptageniidae	3.5	1.7	0.6	1.9
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	15.5	3.6	1.8	7.0
Chironomidae pupae	11.2	1.5	0.5	4.4
Simuliidae		1.0	0.9	0.6
Tipulidae		1.0		0.3
Other[3]	2.6	1.4	1.1	1.7
Plecoptera (stoneflies)				
Perlodidae	0.5			0.2
Nemouridae			4.3	1.4
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		2.1		0.7
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult		3.1		1.0
Other[6]	3.4			1.1
Hemiptera[7] (true bug)		15.8	4.5	6.8
Oligochaeta[8] (worms)		1.3		0.4
Other[9]	5.3		21.5	8.9
TOTAL	**69.1**	**55.4**	**76.3**	**66.9**

Table 3.78. (cont.)

PREY ORGANISMS	0 + n=18	1 + n=15	2 + n=12	All ages n=45
Terrestrial invertebrates				
Trichoptera adult	5.8		0.6	2.1
Diptera (flies, midges)				
Empididae adult	8.0	3.2		3.7
Chironomidae adults		3.1		1.4
Other adults[10]	2.5	19.5	1.3	7.4
Coleoptera (beetles)				
Scarabaeidae			0.5	0.2
Staphylinidae	0.5			0.2
Carabidae			0.6	0.2
Other[11]	0.5	1.4	1.5	1.1
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae	1.6			0.5
Aphididae	2.7	1.9		1.5
Cercopidae				
Other[13]	4.2	0.6		1.6
Hymenoptera (bees, wasps, ants)				
Formicidae	2.6	9.7	4.1	5.5
Other[14]	0.5	1.8	0.5	0.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	2.2	0.5	1.2	1.3
Lepidoptera		0.5	0.5	0.3
Other[16]		1.4	12.3	4.6
Total	31.1	43.6	23.1	32.5

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
6 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.79. Mean annual number frequencies of prey items consumed by cutthroat trout in Skookum Creek for 1988.

PREY ORGANISMS	0+ n=3	1+ n=4	2+ n=1	All ages n=8
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	1.8			0.6
Rhyacophilidae				
Limnephilidae	10.5			3.5
Brachycentridae	1.9			0.6
Glossosomatidae				
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	9.1	16.7		8.6
Baetidae				
Heptageniidae		3.3		1.1
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	18.5	3.4		7.3
Chironomidae pupae	10.8			3.6
Simuliidae	1.8	3.3		1.7
Tipulidae		0.8	3.7	1.5
Other[3]				
Plecoptera (stoneflies)				
Perlodidae				
Nemouridae				
Chloroperlidae				
Other[4]			3.7	1.2
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult				
Other[6]			3.7	0.8
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)	2.5			0.8
Other[9]				
TOTAL	**56.9**	**27.5**	**11.1**	**31.7**

Table 3.79. (cont.)

PREY ORGANISMS	0 + n=3	1 + n=4	2 + n=1	All ages n=8
Terrestrial invertebrates				
Trichoptera adult	5.0	4.0		3.0
Diptera (flies, midges)				
Empididae adult	32.7	28.3	37.0	32.7
Chironomidae adults		0.3		0.1
Other adults[10]	1.9	9.4	14.8	8.7
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae		1.5		0.5
Carabidae	1.8			0.6
Other[11]			3.7	1.2
Hemiptera[12] (true bugs)		0.4		0.1
Homoptera				
Cicadellidae	1.9	1.5	3.7	2.4
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		8.5	11.1	6.5
Other[14]		2.2	11.1	4.4
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		11.1	3.7	4.9
Lepidoptera		3.3	3.7	2.3
Other [16]		0.4		0.1
Total	**43.3**	**73.8**	**88.8**	**67.5**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae. Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae. Mycetophilidae, Tabanidae. Muscidae, Sciaridae, Bibionidae. Pharidae. Dryomyzidae, Dolichopodidae. Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.80. Mean annual weight frequencies of prey items consumed by cutthroat trout in Skookum Creek for 1988.

PREY ORGANISMS	0 + n=3	1 + n=4	2 + n=1	All ages n=8
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	6.3			2.1
Rhyacophilidae				
Limnephilidae	1.1			0.4
Brachycentridae	0.6			0.2
Glossosomatidae				
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	11.6	7.5		6.4
Baetidae				
Heptageniidae		3.5		1.2
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	9.7	0.2		3.3
Chironomidae pupae	6.8			2.3
Simuliidae	0.4	1.0		0.5
Tipulidae			15.7	5.2
Other[3]				
Plecoptera (stoneflies)				
Perlodidae				
Nemouridae				
Chloroperlidae				
Other[4]			0.4	0.1
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult				
Other[6]			0.4	0.1
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)	1.3			0.4
Other[9]				
TOTAL	**37.8**	**12.2**	**16.1**	**21.7**

Table 3.80. (cont.)

PREY ORGANISMS	0 + n=3	1 + n=4	2 + n=1	All ages n=8
Terrestrial invertebrates				
Trichoptera adult	7.5	1.1		2.9
Diptera (flies, midges)				
Empididae adult	40.9	34.9	22.6	32.8
Chironomidae adults		0.1		<0.1
Other adults[10]	5.1	2.6	7.4	5.1
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae		0.1		<0.1
Carabidae	7.0		0.4	2.4
Other[11]			0.4	0.1
Hemiptera[12] (true bugs)		1.8		0.6
Homoptera				
Cicadellidae	0.6	0.7	0.4	0.6
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		14.6	16.4	10.3
Other[14]		0.2	2.6	0.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		28.1	24.8	17.6
Lepidoptera		3.4	9.9	4.4
Other [16]		0.1		0.1
Total	**61.1**	**87.7**	**84.9**	**77.9**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, **Entomobryidae,** Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

age classes combined, Formicidae and Arachnidae at 66.7 percent each had the highest occurrence frequency followed by Empididae adult at 60.9 percent.

Table 3.82 lists index of relative importance (IRI) for prey items consumed by cutthroat trout in Skookum Creek. For 0+ cutthroat trout, Chironomidae larvae had the highest IRI at 16.0 percent followed by Empididae adults (13.7%) and Chironomidae pupae (11.4%). For 1+ cutthroat trout, Arachnidae had the highest IRI at 12.9 percent followed by Formicidae (11.3%) and other Diptera adults (11.2%). For 2+ cutthroat trout, other Diptera adults had the highest IRI at 20 percent followed by other Hymenoptera (13.4%) and Empididae adults (10.0%). For all age classes combined, other Diptera adults had the highest IRI at 12.5 percent, followed by Empididae adults (10.9%) and Chironomidae larvae (7.1%).

3.5.2 CEE CEE AH CREEK

A total of 48 brown trout, and 27 brook trout stomachs were collected from Cee Cee Ah Creek for analysis. Trout food items consisted of 59 invertebrate families representing 17 orders.

3.5.2.1 BROWN TROUT

Table 3.83 lists the number frequency for prey items consumed by brown trout in Cee Cee Ah Creek. For 0+ brown trout, Baetidae had the highest numerical frequency at 25.1 percent followed by Elmidae larvae at 10.4 percent and Chironomidae larvae at 9.8 percent. For 1+ brown trout, Brachycentridae (11.2%) had the highest numerical percentage followed by Simuliidae (10.8%) and Ephemerellidae (9.7%). For 2+ brown trout, Limnephilidae (18.9%) had the highest numerical frequency followed by Brachycentridae (14.9%) and Baetidae (8.1%). For 3+ brown trout, Limnephilidae (48.1%) had the highest number percentage followed by Brachycentridae (12.1%) and Formicidae (7.6%). For 4+ brown trout, Limnephilidae (72.1 %) had the highest numerical percentage followed by Formicidae (13.6%), Oligochaeta and Rhyacophilidae at (7.1% each). For 5+ brown trout, Limnephilidae was the only prey item consumed and therefor had a numerical frequency of 100 percent. For all age classes of brown trout combined, Limnephilidae had the highest numerical frequency at 40.7 percent followed by Baetidae at 6.8 percent and Brachycentridae at 6.4 percent.

Table 3.81. Mean annual occurrence frequencies of prey items consumed by cutthroat trout in Skookum Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=3	n=4	n=1	n=8
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	25.0			8.3
Rhyacophilidae				
Limnephilidae	25.0			8.3
Brachycentridae	50.0			16.7
Glossosomatidae				
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	7.5	50.0		19.2
Baetidae				
Heptageniidae		50.0		16.7
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	100.0	50.0		50.0
Chironomidae pupae	75.0			25.0
Simuliidae	25.0	50.0		25.0
Tipulidae			100.0	33.3
Other[3]	50.0			16.7
Plecoptera (stoneflies)				
Perlodidae				
Nemouridae				
Chloroperlidae				
Other[4]		25.0	100.0	33.3
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult				
Other[6]			100.0	33.3
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)	2.5			0.8
Other[9]				

Table 3.81. (cont.)

	0+	1+	2+	All ages
PREY ORGANISMS	n=3	n=4	n=1	n=8
Terrestrial invertebrates				
Trichoptera adult	25.0	100.0		41.7
Diptera (flies, midges)				
Empididae adult	32.7	50.0	100.0	60.9
Chironomidae adults		25.0		8.3
Other adults[10]		25.0		25.0
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae		25.0		8.3
Carabidae	25.0			8.3
Other[11]			100.0	33.3
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae	1.9	25.0	100.0	42.3
Aphididae				
Cercopidae				
Other[13]		25.0		8.3
Hymenoptera (bees, wasps, ants)				
Formicidae		100.0	100.0	66.7
Other[14]		37.5	100.0	91.6
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		100.0	100.0	66.7
Lepidoptera		50.0	100.0	50.0
Other[16]		25.0	100.0	8.3

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda. Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.82. Mean annual index of relative importance frequencies (IRI) of prey items consumed by cutthroat trout in Skookum Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=3	n=4	n=1	n=8
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	4.2			1.4
Rhyacophilidae				
Limnephilidae	8.4			2.8
Brachycentridae	5.8			1.9
Glossosomatidae				
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	11.3	7.5		6.2
Baetidae		5.8		1.9
Heptageniidae				
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	16.0	5.4		7.1
Chironomidae pupae	11.4			3.8
Simuliidae	3.4	5.4		3.1
Tipulidae			7.5	2.5
Other[3]				
Plecoptera (stoneflies)				
Perlodidae				
Nemouridae				
Chloroperlidae				
Other[4]			6.5	2.2
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult				
Other[6]			6.6	2.2
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)	4.1			1.4
Other[9]				
TOTAL	64.6	24.1	20.6	36.4

Table 3.82. (cont.)

PREY ORGANISMS	0 + n=3	1 + n=4	2 + n=1	All ages n=8
Terrestrial invertebrates				
Trichoptera adult	5.4	9.6		5.0
Diptera (flies, midges)				
Empididae adult	13.7	8.9	10.0	10.9
Chironomidae adults		2.1		0.7
Other adults[10]	6.4	11.2	20.0	12.5
Coleoptera (beetles)				
Scarabaeidae				
Staphylinide		2.1		0.7
Carabidae	4.1			1.4
Other[11]			6.6	2.2
Hemiptera[12] (true bugs)		2.2		0.7
Homoptera				
Cicadellidae	5.8	2.2	6.5	4.8
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		11.3	8.0	6.4
Other[14]		4.2	13.4	5.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		12.9	8.1	7.0
Lepidoptera		5.8	7.1	4.3
Other [16]		2.1		0.7
Total	**35.2**	**74.6**	**79.5**	**63.2**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda. Gammaridae, Hydracarina. Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobtyidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.83. Mean annual number frequencies of prey items consumed by brown trout in Cee Cee Ah Creek for 1988.

	0 +	1 +	2 +	3 +	4 +	5 +	All ages
PREY ORGANISMS	n=13	n=14	n=12	n=6	n=2	n=1	n=48
Aquatic invertebrates							
Trichoptera (caddisflies)							
Hydropsychidae		2.0	3.9				1.0
Rhyacophilidae		5.1	1.3		7.1		2.3
Limnephilidae	0.8	7.7	18.9	48.1	72.1	100.0	40.7
Brachycentridae		11.2	14.9	12.1			6.4
Glossosomatidae							
Trichop. pupae							
Other[1]	0.8	2.0	0.3				1.2
Ephemeroptera (mayflies)							
Ephemerellidae	3.8	9.7	5.2				3.2
Baetidae	25.1	7.3	8.1				6.8
Heptageniidae	7.3	9.1					2.7
Other[2]	7.1		1.3	2.1			1.8
Diptera (flies, midges)							
Chironomidae larvae	9.8	7.8	1.5	3.8			3.8
Chironomidae pupae				3.7			0.6
Simuliidae	9.0	10.8	0.3				3.4
Tipulidae			1.3				0.2
Other[3]	2.4	1.0	4.0	3.5			1.8
Plecoptera (stoneflies)							
Perlodidae	6.0	1.7					1.4
Nemouridae							
Chloroperlidae							
Other[4]		0.9					0.2
Gastropoda[5] (snails)	1.7	3.8	2.9	2.0			1.8
Osteichthyes (fish)							
Salmonidae			0.3				0.1
Cottidae							
Unidentified			1.3				0.2
Coleoptera (beetles)							
Elmidae larvae	10.4	1.2					2.0
Elmidae adult	2.1	1.6	0.4	3.8			2.2
Other[6]		9.3	0.7	1.7			2.0
Hemiptera[7] (true bug)			0.2				<0.1
Oligochaeta[8] (worms)	2.1	0.5	6.5		7.1		2.7
Other[9]	0.8	1.8		5.2			1.3
TOTAL	**94.2**	**98.5**	**77.0**	**84.0**	**84.6**	**100.0**	**89.8**

Table 3.83. (cont.)

	0 +	1 +	2 +	3 +	4 +	5 +	All ages
PREY ORGANISMS	n=13	n=14	n=12	n=6	n=2	n=1	n=48
Terrestrial invertebrates							
Trichoptera adult			0.2	1.7			0.3
Diptera (flies, midges)							
Empididae adult		0.5	0.2				0.1
Chironomidae adults							
Other adults[10]		0.6	2.6				0.5
Coleoptera (beetles)							
Scarabaeidae							
Staphylinidae	0.8		0.7				0.3
Carabidae			0.2				<0.1
Other[11]							
Hemiptera[12] (true bugs)			0.4				<0.1
Homoptera							
Cicadellidae		0.2	2.3	2.1			0.8
Aphididae			3.0				0.5
Cercopidae			1.0				0.2
Other[13]			0.2				0.8
Hymenoptera (bees, wasps, ants)							
Formicidae	2.4	0.6	4.8	7.6	13.6		4.8
Other[14]		0.2		4.2			0.7
Orthoptera[15] (grasshoppers)		0.2	1.7				0.3
Araneida (spiders, mites)							
Arachnidae			0.4				0.1
Lepidoptera							
Other[16]	2.4	0.5	4.9	2.1			0.9
Total	**5.6**	**2.8**	**22.6**	**16.0**	**15.3**		**10.3**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae. Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae. Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphiroidae, Hydrophilidae.
7 Corixidae. Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea. Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae. Muscidae. Sciaridae. Bibionidae, Pharidae, Dryomyzidae. Dolichopodidae. Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae. Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae. Chrysopidae, Machilidae, Forficulidae. Glomerida. Psocidae. Unidentified.

Table 3.84 lists the percent composition by weight for prey items consumed by brown trout in Cee Cee Ah Creek. For 0+ brown trout, Oligochaeta had the highest weight frequency at 22.4 percent followed by Elmidae larvae at 11.7 percent and other Ephemeroptera at 10.6 percent. For 1+ brown trout, Oligochaeta (18.3%) had the greatest weight frequency followed by other Coleoptera (15.6%) and Orthoptera (13.2%). For 2+ brown trout, Oligochaeta (21.4%) had the highest weight percentage followed by Limnephilidae (16.4%) and Salmonidae (14.2%). For 3+ brown trout, Limnephilidae had the highest weight frequency at 50.4 percent followed by other Diptera larvae (21.5%) and Cicadellidae (6.9%). For 4+ brown trout, Limnephilidae (49.7%) had the highest weight frequency followed by Oligochaeta (49.5%) and Formicidae (0.5%). For 5+ brown trout, Limnephilidae was the only prey item found and therefor had a weight frequency of 100 percent. For all age classes combined, Limnephilidae had the highest weight frequency at 36.7 percent followed by Oligochaeta at 18.4 percent and other Diptera larvae at 5.2 percent.

Table 3.85 lists the frequency of occurrence for prey items consumed by brown trout in Cee Cee Ah Creek. For 0+ brown trout, Baetidae had the highest occurrence frequency at 47.2 percent followed by Simuliidae at 45.8 percent and Elmidae adult at 33.3 percent. For 1+ brown trout, Ephemerellidae (44.5%) had the highest percent occurrence followed by Chironomidae larvae (43.1%) and Baetidae (33.3%). For 2+ brown trout, Limnephilidae (58.3%) occurred most frequently followed by Brachycentridae (44.5%) and Formicidae (38.9%). For 3+ brown trout, Limnephilidae had the highest frequency of occurrence at 100 percent, followed by Brachycentridae at 50.0 percent and Chironomidae larvae, Elmidae adult, and Formicidae at 33.3 percent each. For 4+ brown trout, Limnephilidae had the highest occurrence frequency at 100 percent followed by Rhyacophilidae, Oligochaeta, and Formicidae at 50.0 percent each. For 5+ brown trout, Limnephilidae had 100.0 percent occurrence as only one fish was collected. For all age classes combined, Limnephilidae had the highest frequency of occurrence at 65.8 percent followed by Formicidae at 24.1 percent and Brachycentridae at 19.7 percent.

Table 3.86 lists the index of relative importance (IRI) for prey items consumed by brown trout in Cee Cee Ah Creek. For 0+ brown trout, Baetidae had the highest IRI at 16.8 percent followed by Simuliidae at 11.2 percent and Elmidae larvae at 10.0 percent. For

Table 3.84. Mean annual weight frequencies of prey items consumed by brown trout in Cee Cee Ah Creek for 1988.

PREY ORGANISMS	0 + n=13	1 + n=14	2 + n=12	3 + n=6	4 + n=2	5 + n=1	All ages n=48
Aquatic invertebrates							
Trichoptera (caddisflies)							
Hydropsychidae		7.2	1.1				1.4
Rhyacophilidae		0.2	0.2		0.2		0.1
Limnephilidae	0.3	3.7	16.4	50.4	49.7	100	36.7
Brachycentridae		8.4	6.3	2.7			2.9
Glossosomatidae							
Trichop. pupae							
Other[1]	<0.1	1.5	<0.1				0.1
Ephemeroptera (mayflies)							
Ephemerellidae	6.8	9.0	2.9				3.1
Baetidae	9.7	3.0	1.4				2.4
Heptageniidae	3.9	1.3					0.9
Other[2]	10.6		0.1				1.7
Diptera (flies, midges)							
Chironomidae larvae	3.8	0.3	<0.1	1.1			0.9
Chironomidae pupae			<0.1				<0.1
Simuliidae	5.4	1.1	<0.1				2.3
Tipulidae			1.2				0.2
Other[3]	1.0	0.2	8.2	21.5			5.2
Plecoptera (stoneflies)							
Perlodidae	8.2	1.1					1.6
Nemouridae							
Chloroperlidae							
Other[4]		0.6					0.1
Gastropoda[5] (snails)	5.7	5.4	2.6	4.3			3.0
Osteichthyes (fish)							
Salmonidae			14.2				2.4
Cottidae							
Unidentified			2.2				0.4
Coleoptera (beetles)							
Elmidae larvae	11.7	0.1					2.0
Elmidae adult	6.3	7.8	0.1	1.1			2.6
Other[6]		15.6	<0.1	0.4			2.7
Hemiptera[7] (true bug)			0.1				
Oligochaeta[8] (worms)	22.4	18.3	21.4		49.5		18.4
Other[9]	0.3	0.6		0.1			0.2
TOTAL	96.1	85.4	78.7	81.6	199.4	**100.0**	91.6

Table 3.84. (cont.)

PREY ORGANISMS	0 + n=13	1 + n=14	2 + n=12	3 + n=6	4 + n=2	5 + n=1	All ages n=48
Terrestrial invertebrates							
Trichoptera adult			0.1	3.5			0.6
Diptera (flies, midges)							
Empididae adult		0.2	<0.1				<0.1
Chironomidae adults							
Other adults[10]			0.8				0.1
Coleoptera (beetles)							
Scarabaeidae							
Staphylinidae	0.3		<0.1				0.1
Carabidae			<0.1				<0.1
Other[11]							
Hemiptera[12] (true bugs)			0.1				<0.1
Homoptera							
Cicadellidae		0.1	0.7	6.9			1.3
Aphididae			<0.1				<0.1
Cercopidae			0.3				0.1
Other[13]	0.3			1.4			0.3
Hymenoptera (bees, wasps, ants							
Formicidae	3.0	0.1	4.5	3.0	0.5		1.9
Other[14]		1.1		2.1			0.5
Orthoptera[15] (grasshoppers)		13.2	14.0				4.6
Araneida (spiders, mites)							
Arachnidae			0.1				<0.1
Lepidoptera							
Other [16]		0.8	1.2				0.3
Total	**3.6**	**15.5**	**22.3**	**16.9**	**0.5**	**0.0**	**9.8**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae. Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae. Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae. Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae. Cypridae.
10 Anthomyzidae, Mycetophilidae. Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae. Curculionidae, Lathridiidae. Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae. Sphecidae. Chalcidae, Bethyloidea. Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.85. Mean annual occurrence frequencies of prey items consumed by brown trout in Cee Cee Ah Creek for 1988.

	0 +	1 +	2 +	3 +	4 +	5 +	All ages
PREY ORGANISMS	n=13	n=14	n=12	n=6	n=2	n=1	n=48
Aquatic invertebrates							
Trichoptera (caddisflies)							
Hydropsychidae		1.1	16.7				4.6
Rhyacophilidae		22.2	16.7		50.0		14.8
Limnephilidae	5.6	30.6	58.3	100.0	100.0	100.0	65.8
Brachycentridae		23.6	44.5	50.0			19.7
Glossosomatidae							
Trichop. pupae							
Other[1]	1.4	9.0	2.1				2.1
Ephemeroptera (mayflies)							
Ephemerellidae	15.3	44.5	25.0				14.1
Baetidae	47.2	33.3	33.3				19.0
Heptageniidae	11.1	11.1					3.7
Other[2]	8.3		8.3	8.3			4.2
Diptera (flies, midges)							
Chironomidae larvae	25.0	43.1	5.6	33.3			17.8
Chironomidae pupae			12.5				2.1
Simuliidae	45.8	18.1	4.2				11.4
Tipulidae			16.7				2.8
Other[3]	5.6	3.7	5.6	11.1			13.1
Plecoptera (stoneflies)							
Perlodidae	16.7	27.8					7.4
Nemouridae							
Chloroperlidae							
Other[4]		8.3					1.4
Gastropoda[5] (snails)	1.4	7.3	9.7	4.7			3.8
Osteichthyes (fish)							
Salmonidae			4.2				0.7
Cottidae							
Unidentified			16.7				2.8
Coleoptera (beetles)							
Elmidae larvae	27.8	5.6					4.7
Elmidae adult	33.3	18.1	5.6	33.3			15.1
Other[6]		8.3	13.9	16.7			6.5
Hemiptera[7] (true bug)			4.2				0.7
Oligochaeta[8] (worms)	11.1	11.1	16.7		50.0		14.8
Other[9]	2.8	8.3	4.2				2.6

Table 3.85. (cont.)

	0 +	1 +	2 +	3 +	4 +	5 +	All ages
PREY ORGANISMS	n=13	n=14	n=12	n=6	n=2	n=1	n=48
Terrestrial invertebrates							
Trichoptera adult			4.2	16.7			3.5
Diptera (flies, midges)							
Empididae adult		4.2	4.2				1.4
Chironomidae adults		0.9	4.8				0.9
Other adults[10]							
Coleoptera (beetles)							
Scarabaeidae							
Staphylinidae	8.3		4.2				2.1
Carabidae			4.2				0.7
Other[11]							
Hemiptera[12] (true bugs)			4.2				0.7
Homoptera							
Cicadellidae		4.2	12.5	16.7			5.6
Aphididae			12.5				2.1
Cercopidae			4.2				0.7
Other[13]							
Hymenoptera (bees, wasps, ants)							
Formicidae	16.7	5.6	38.9	33.3	50.0		24.1
Other[14]		4.2		16.7			3.5
Orthoptera[15] (grasshoppers)		2.1	8.3				1.8
Araneida (spiders, mites)							
Arachnidae			13.9				2.3
Lepidoptera							
Other [16]		5.6	10.5				2.7

1 Hydroptilidae, Lepidostomatidae, Leptoceridae. Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae. Muscidae, Tabanidae. Syrphidae.
4 Peltoperlidae. Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea. Nematoda, Gammaridae. Hydracarina. Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae. Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae. Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae. Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae. Tetrigidae.
16 Sminthuridae, Entomobryidae. Chrysopidae. Machilidae, Forficulidae, Glomerida. Psocidae, Unidentified.

1+ brown trout, Ephemerellidae had the greatest IRI at 8.7 percent followed by other Coleoptera (8.3%) and other Trichoptera (7.4%). For 2+ brown trout, Limnephilidae (14.9%) had the highest IRI followed by Brachycentridae (9.4%) and Ephemerellidae (6.7%). For 3+ brown trout, Limnephilidae had the greatest IRI at 32.3 percent followed by Brachycentridae at 10.4 percent and other Diptera larvae at 9.8 percent. For 4+ brown trout, Limnephilidae (51.2%) had the highest IRI followed by Oligochaeta (21.4%) and Formicidae (16.1%). For the only 5+ brown trout collected, Limnephilidae had an IRI at 100 percent. For all age classes combined, Limnephilidae had the greatest IRI at 34.2 percent followed by Oligochaeta at 6.0 percent and Formicidae at 5.7 percent.

3.5.2.2 BROOK TROUT

Table 3.87 lists the percent composition by number for prey items consumed by brook trout in Cee Cee Ah Creek. For 0+ brook trout, Baetidae had the highest numerical percent at 23.3 percent followed by Limnephilidae at 13.7 percent and Chironomidae larvae at 12.6 percent. For 1+ brook trout, Limnephilidae (13.1%) had the highest numerical percent followed by Rhyacophilidae (9.6%) and Chloroperlidae and Carabidae (8.3% each). For 2+ brook trout, 100 percent of items consumed were Limnephilidae. For 3+ brook trout; Limnephilidae had the highest numerical frequency at 60.0 percent followed by Brachycentridae and other Plecoptera at 20.0 percent each. For all age classes combined, Limnephilidae (46.7%) had the highest numerical percentage, followed by Baetidae (7.0%) and Brachycentridae (6.4%).

Table 3.88 lists the percent composition by weight for prey items consumed by brook trout in Cee Cee Ah Creek. For 0+ brook trout, Rhyacophilidae had the highest weight frequency at 25.6 percent followed by Formicidae at 22.9 percent and Oligochaeta at 15.7 percent. For 1+ brook trout, Scarabidae (20.6%) had the highest weight percentage followed by Perlodidae (15.2%) and Oligochaeta (6.5%). For 2+ brook trout, Limnephilidae was the only item consumed and had a weight frequency of 100 percent. For 3+ brook trout, Limnephilidae (50.3%) had the highest weight percentage followed by other Plecoptera (44.2%) and Brachycentridae (5.5%). For all age classes combined, Limnephilidae (39.3%) had the greatest weight frequency followed by Rhyacophilidae (6.6%) and Formicidae (5.8%).

Table 3.86. Mean annual index of relative importance frequencies (IRI) of prey items consumed by brown trout in Cee Cee Ah Creek for 1988.

	0+	1+	2+	3+	4+	5+	All ages
PREY ORGANISMS	n=13	n=14	n=12	n=6	n=2	n=1	n=48
Aquatic invertebrates							
Trichoptera (caddisflies)							
Hydropsychidae		2.7	4.0				
Rhyacophilidae		5.8	1.9		11.5		3.2
Limnephilidae	1.3	5.5	14.9	32.3	51.2	100.0	34.2
Brachycentridae		6.4	9.4	10.4			4.4
Glossosomatidae							
Trichop. pupae							
Other[1]	1.4	7.4	0.4				1.6
Ephemeroptera (mayflies)							
Ephemerellidae	5.4	8.7	6.7				3.5
Baetidae	16.8	6.2	5.0				4.7
Heptageniidae	3.7	2.8					1.1
Other[2]	4.2	2.1	1.9	3.2			1.9
Diptera (flies, midges)							
Chironomidae larvae	7.2	7.0	2.9	6.2			3.9
Chironomidae pupae			1.9				0.3
Simuliidae	11.2	5.7	0.4				2.9
Tipulidae			2.0				0.3
Other3	3.0	1.6	3.0	9.8			2.9
Plecootera (stoneflies)							
Perlodidae	9.3	4.6	5.2				3.2
Nemouridae							
Chloroperlidae							
Other[4]		1.4					0.2
Gastropoda (snails)	2.6	6.7		3.7			2.2
Osteichthyes (fish)							
Salmonidae			1.8				0.3
Cottidae							
Unidentified			2.1				0.4
Coleoptera (beetles)							
Elmidae larvae	10.0	1.0					1.8
Elmidae adult	9.0	3.3	1.1	6.2			3.3
Other[6]		8.3	2.1	3.2			2.3
Hemiptera[7] (true bug)			.4				0.1
Oligochaeta[8] (worms)	5.9	2.0	6.4		21.4		6.0
Other[9]	1.3	2.7	1.1	3.7			1.5
TOTAL	92.3	91.9	74.4	78.7	84.1	100.0	86.2

Table 3.86. (cont.)

PREY ORGANISMS	0 + n=13	1 + n=14	2 + n=12	3 + n=6	4 + n=2	5 + n=1	All ages n=48
Terrestrial invertebrates							
Trichoptera adult			0.2	3.7			0.7
Diptera (flies, midges)							
Empididae adult		0.8	0.4				0.2
Chironomidae adults							
Other adults[10]		0.9	4.7				1.1
Coleoptera (beetles)							
Scarabaeidae							
Staphylinidae	2.3		0.5				0.5
Carabidae			0.4				0.1
Other[11]							
Hemiptera[12] (true bugs)			0.6				0.1
Homoptera							
Cicadellidae		0.7	1.8	4.1			1.1
Aphididae			1.5				0.3
Cercopidae			0.5				0.1
Other[13]	3.0		0.4	3.2			1.1
Hymenoptera (bees, wasps, ants							
Formicidae	3.3	0.9	6.9	7.1	16.1		5.7
Other[14]		0.9		3.7			0.8
Orthoptera[15] (grasshoppers)		2.8	4.8				1.0
Araneida (spiders, mites)							
Arachnidae			1.9				0.3
Lepidoptera							
Other [16]		2.5	2.0				0.7
Total	**8.6**	**9.5**	**26.6**	**21.8**	**16.1**	**0.0**	**13.8**

1 Hydroptilidaa, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricory-thidae, Unidentified.
3 Ceratopogonidae, Culicidae. Empididae. Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae. Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae. Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae. Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae. Pharidae. Dryomyzidae. Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae. Pselaphidae, Curculionidae. Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae. Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae. Bethyloidea. Apidae.
15 Acrididae. Tetrigidae.
16 Sminthuridae. Entomobryidae. Chrysopidae, Machilidae. Forficulidae. Glomerida. Psocidae. Unidentified.

Table 3.87. Mean annual number frequencies of prey items consumed by brook trout in Cee Cee Ah Creek for 1988.

	0 +	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=9	n=16	n=1	n=1	n=27
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae	2.6				0.7
Rhyacophilidae	12.5	9.6			5.5
Limnephilidae	13.7	13.1	100.0	60.0	46.7
Brachycentridae	2.2	3.3		20.0	6.4
Glossosomatidae					
Trichop. pupae					
Other[1]					
Ephemeroptera (mayflies)					
Ephemerellidae	2.2				0.6
Baetidae	23.3	4.8			7.0
Heptageniidae		0.5			0.1
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	12.6	8.0			5.2
Chironomidae pupae					
Simuliidae		3.4			0.9
Tipulidae		0.7			0.2
Other[3]					
Plecoptera (stoneflies)					
Perlodidae	4.0	2.8			1.7
Nemouridae		2.8			0.7
Chloroperlidae		8.3			2.1
Other[4]	1.3	2.1		20.0	5.9
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae		0.7			0.2
Elmidae adult		0.7			0.2
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	1.3	0.5			0.5
Other[9]	13.5	21.6			8.8
TOTAL	**89.2**	**82.9**	**100.0**	**100.0**	**93.3**

Table 3.87. (cont.)

PREY ORGANISMS	0+ n=9	1 + n=16	2 + n=l	3 + n=1	All ages n=27
Terrestrial invertebrates					
Trichoptera adult		0.7			0.2
Diptera (flies, midges)					
Empididae adult					
Chironomidae adults					
Other adults[10]	0.9	0.7			0.4
Coleoptera (beetles)					
Scarabaeidae		1.0			0.3
Staphylinidae					
Carabidae		8.3			2.1
Other[11]					
Hemiptera[12] (true bugs)		0.7			0.2
Homoptera					
Cicadellidae		1.2			0.3
Aphididae	2.2				0.6
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae	0.9	0.7			0.4
Other[14]	0.9	0.7			0.4
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnida					
Lepidoptera		0.7			0.2
Other[16]	5.1	3.7			2.2
Total	**10.0**	**18.4**	**0.0**	**0.0**	**7.3**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethylidae, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.88. Mean annual weight frequencies of prey items consumed by brook trout in Cee Cee Ah Creek for 1988.

	0 +	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=9	n=16	n=1	n=1	n=27
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae	1.5				0.4
Rhyacophilidae	25.6	0.9			6.6
Limnephilidae	4.4	2.6	100.0	50.3	39.3
Brachycentridae	2.9	0.2		5.5	2.2
Glossosomatidae					
Trichop. pupae					
Other[1]					
Ephemeroptera (mayflies)					
Ephemerellidae	2.4				0.6
Baetidae	6.4	0.6			1.8
Heptageniidae		0.1			<0.1
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	2.8	1.0			1.0
Chironomidae pupae					
Simuliidae		2.5			0.6
Tipulidae		2.0			0.5
Other[3]					
Plecoptera (stoneflies)					
Perlodidae	2.3	15.2			4.4
Nemouridae		<0.1			<0.1
Chloroperlidae		3.6			0.1
Other[4]	0.2	1.8		44.2	11.7
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae		1.8			0.5
Elmidae adult		0.3			0.1
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	15.7	6.5			5.6
Other[9]	2.3	24.0			6.6
TOTAL	**66.5**	**63.2**	**100.0**	**100.0**	**81.7**

Table 3.88. {cont.)

	0+	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=9	n=16	n=l	n=1	n=27
Terrestrial invertebrates					
Trichoptera adult		1.1			0.3
Diptera (flies, midges)					
Empididae adult					
Chironomidae adults					
Other adults[10]	2.1	0.3			0.6
Coleoptera (beetles)					
Scarabaeidae		20.6			5.2
Staphylinidae					
Carabidae		3.6			0.9
Other[11]					
Hemiptera[12] (true bugs)		0.3			0.1
Homoptera					
Cicadellidae		0.3			0.1
Aphididae	2.3	3.3			0.6
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae	22.9	0.1			5.8
Other[14]	2.1				1.3
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae					
Lepidoptera		5.0			1.3
Other[16]	4.2	2.5			1.7
Total	**33.6**	**37.1**	**0.0**	**0.0**	**17.9**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae. Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.89 lists the frequency of occurrence for prey items consumed by brook trout in Cee Cee Ah Creek. For 0+ brook trout, Baetidae (70.0%) had the highest occurrence frequency followed by Chironomidae larvae (62.5%) and Limnephilidae (42.5%). For 1+ brook trout, Heptageniidae occurred most frequently at 50.0 percent followed by Baetidae at 46.3 percent and Limnephilidae at 31.9 percent. For the single 2+ brook trout captured, Limnephilidae was the only item consumed and had an occurrence of 100 percent. Only one 3+ brook trout was captured and resulted in 100 percent occurrence for Limnephilidae, Brachycentridae, and other Plecoptera. For all age classes combined, Limnephilidae (68.6%) had the highest occurrence followed by Brachycentridae (36.3%) and Baetidae (27.9%).

Table 3.90 lists the index of relative importance (IRI) for prey items consumed by brook trout in Cee Cee Ah Creek. For 0+ brook trout, Baetidae had the highest IRI at 15.4 percent followed by Chironomidae larvae at 11.9 percent and Rhyacophilidae at 11.7 percent. For 1+ brook trout, Baetidae (8.1%) had the greatest IRI followed by Chloroperlidae (7.9%) and Carabidae (7.3%). For 2+ brook trout, Limnephilidae had a 100 percent IRI. For 3+ brook trout, Limnephilidae (43.6%) had the greatest IRI followed by other Plecoptera (34.1%) and Brachycentridae (22.3%). For all age classes combined, Limnephilidae had the highest IRI at 40.2 percent followed by other Plecoptera at 9.9 percent and Brachycentridae at 7.9 percent.

3.5.3 TACOMA CREEK

Stomachs were collected from 51 brook trout and 11 cutthroat trout in Tacoma Creek. Prey items consisted of 31 invertebrate families representing 14 orders.

3.5.3.1 BROOK TROUT

Table 3.91 lists the percent composition by number for prey items consumed by brook trout in Tacoma Creek. For 0+ brook trout, Chironomidae larvae had the greatest numerical frequency at 20.1 percent, followed by Brachycentridae at 15.7 percent and Nemouridae at 15.2 percent. For 1+ brook trout, Brachycentridae (11 .1%) had the greatest numerical frequency followed by Simuliidae (9.8%) and Nemouridae (7.9%). For 2+ brook trout, Chironomidae adults (20.8%) had the highest numerical frequency followed by Aphididae (20.0%) and Baetidae (12.5%). For all age classes

Table 3.89. Mean annual occurrence frequencies of prey items consumed by brook trout in Cee Cee Ah Creek for 1988.

	0 +	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=9	n=16	n=1	n=1	n=27
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae	10.0				2.5
Rhyacophilidae	32.5	25.6			14.5
Limnephilidae	42.5	31.9	100.0	100.0	68.6
Brachycentridae	22.5	22.5		100.0	36.3
Glossosomatidae					
Trichop. pupae					
Other[1]					
Ephemeroptera (mayflies)					
Ephemerellidae	22.5				5.6
Baetidae	70.0	46.3			29.1
Heptageniidae		50.0			1.3
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	62.5	11.3			18.5
Chironomidae pupae					
Simuliidae		17.5			4.4
Tipulidae		3.1			0.8
Other[3]					
Plecoptera (stoneflies)					
Perlodidae	22.5	9.4			8.0
Nemouridae		6.3			1.6
Chloroperlidae		25.0			6.3
Other[4]	3.3	6.7	33.3		10.8
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae		3.1			0.8
Elmidae adult		3.1			0.8
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	10.0				3.8
Other[9]		4.4			0.8

Table 3.89. (cont.)

PREY ORGANISMS	0 + n=9	1 + n=16	2 + n=1	3 + n=1	All ages n=27
Terrestrial invertebrates					
Trichoptera adult		3.1			0.8
Diptera (flies, midges)					
Empididae adult					
Chironomidae adults					
Other adults[10]	6.3	2.5			2.2
Coleoptera (beetles)					
Scarabaeidae		5.0			3.1
Staphylinidae					
Carabidae		25.0			6.3
Other[11]					
Hemiptera[12] (true bugs)					
Homoptera					
Cicadellidae		3.3			0.8
Aphididae	22.5				5.6
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae	12.5	3.1			3.9
Other[14]	6.3	1.6			2.0
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae					
Lepidoptera		5.0			1.3
Other [16]	20.0				7.0

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae. Bibionidae, Pharidae. Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.90. Mean annual index of relative importance frequencies (IRI) of prey items consumed by brook trout in Cee Cee Ah Creek for 1988.

	0+	1 +	2 +	3 +	All ages
PREY ORGANISMS	n=9	n=16	n=1	n=1	n=27
Aquatic invertebrates					
Trichoptera (caddisflies)					
Hydropsychidae	2.4				0.6
Rhyacophilidae	11.7	5.7			4.3
Limnephilidae	10.0	7.1	100.0	43.6	40.2
Brachycentridae	4.4	4.9		22.3	7.9
Glossosomatidae					
Trichop. pupae					
Other[1]					
Ephemeroptera (mayflies)					
Ephemerellidae	4.3				1.1
Baetidae	15.4	8.1			5.9
Heptageniidae		2.4			0.6
Other[2]					
Diptera (flies, midges)					
Chironomidae larvae	11.9	3.3			3.8
Chironomidae pupae					
Simuliidae		3.5			0.9
Tipulidae		1.1			0.3
Other[3]					
Plecoptera (stoneflies)					
Perlodidae	4.5	5.1			2.4
Nemouridae		1.7			0.4
Chloroperlidae		7.9			2.0
Other[4]	2.0	3.5		34.1	9.9
Gastropoda[5] (snails)					
Osteichthyes (fish)					
Salmonidae					
Cottidae					
Unidentified					
Coleoptera (beetles)					
Elmidae larvae		1.0			0.3
Elmidae adult		0.7			0.2
Other[6]					
Hemiptera[7] (true bug)					
Oligochaeta[8] (worms)	4.6	1.8			1.6
Other[9]	10.0	20.6			7.7
TOTAL	181.2	177.6	100.0	100.0	89.8

Table 3.90. (cont.)

PREY ORGANISMS	0 + n=9	1 + n=16	2 + n=1	3 + n=1	All ages n=27
Terrestrial invertebrates					
Trichoptera adult		0.9			0.2
Diptera (flies, midges)					
Empididae adult					
Chironomidae adults					
Other adults[10]	2.3	0.8			0.8
Coleoptera (beetles)					
Scarabaeidae		5.3			1.3
Staphylinidae					
Carabidae		7.3			1.8
Other[11]					
Hemiptera[12] (true bugs)		0.8			0.2
Homoptera					
Cicadellidae		1.6			0.4
Aphididae	4.3				1.1
Cercopidae					
Other[13]					
Hymenoptera (bees, wasps, ants)					
Formicidae	5.4	0.7			1.6
Other[14]	2.3	1.3			0.9
Orthoptera[15] (grasshoppers)					
Araneida (spiders, mites)					
Arachnidae					
Lepidoptera		1.5			0.4
Other [16]	5.0	1.9			1.7
Total	**19.3**	**22.1**	**0.0**	**0.0**	**10.4**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

combined, Brachycentridae (9.2%) had the highest numerical percentage followed by Chironomidae larvae (8.9%) and Aphididae (8.4%).

The percent composition by weight for prey items consumed by brook trout in Tacoma Creek are listed in Table 3.92. For 0+ brook trout, Oligochaeta (35.5%) had the greatest weight percentage followed by Chironomidae larvae (11.4%) and Brachycentridae (9.7%). For 1+ brook trout, Oligochaeta (26.7%) had the highest weight percentage followed by Hemiptera (14.4%) and other Diptera (10.9%). For 2+ brook trout, Carabidae had the greatest weight frequency at 35.7 percent followed by Limnephilidae at 20.9 percent and Lepidoptera at 15.7 percent. For all age classes combined, Oligochaeta (20.8%) had the highest weight frequency followed by Carabidae (11.9%) and Limnephilidae (8.8%).

Table 3.93 lists the frequency of occurrence for prey items consumed by brook trout in Tacoma Creek. For 0+ brook trout, Chironomidae larvae had the highest occurrence frequency at 55.5 percent followed by Brachycentridae at 33.9 percent and Baetidae at 28.3 percent. For 1+ brook trout, Ephemerellidae (40.6%) had the highest occurrence frequency followed by Limnephilidae (35.7%) and Oligochaeta (34.8%). For 2+ brook trout, Chironomidae adults had the highest occurrence at 56.3 percent followed by Aphididae and Carabidae at 50.0 percent each. For all age classes combined, Chironomidae larvae occurred most frequently at 31.7 percent followed by Limnephilidae at 28.7 percent and Baetidae at 25.1 percent.

Table 3.94 lists the index of relative importance (IRI) for prey items consumed by brook trout in Tacoma Creek. For 0+ brook trout, Chironomidae larvae had the highest IRI at 16.1 percent followed by Brachycentridae at 11 .O percent and Oligochaeta at 10.3 percent. For 1+ brook trout, Oligochaeta had the highest IRI at 9.4 percent followed by Ephemerellidae at 7.4 percent and Chironomidae larvae at 7.1 percent. For 2+ brook trout, Carabidae (17.2%) had the highest IRI followed by other Diptera larvae (15.5%) and Aphididae (13.8%). For all age classes combined, Oligochaeta had the highest IRI at 8.4 percent followed by Chironomidae larvae (7.7%) and other Diptera larvae (7.1%).

Table 3.91. Mean annual number frequencies of prey items consumed by brook trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=20	n=25	n=6	n=51
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	3.2	2.3		1.8
Rhyacophilidae		1.0	4.2	1.7
Limnephilidae	1.1	2.8	5.8	3.2
Brachycentridae	15.7	11.1	0.8	9.2
Glossosomatidae				
Trichop. pupae				
Other[1]	0.3	1.9		0.7
Ephemeroptera (mayflies)				
Ephemerellidae	5.7	5.4	4.2	5.1
Baetidae	4.5	6.1	12.5	7.7
Heptageniidae	0.3	2.0		0.8
Other[2]	0.3	0.4		0.2
Diptera (flies, midges)				
Chironomidae larvae	20.1	6.6		8.9
Chironomidae pupae	6.6			2.2
Simuliidae	5.9	9.8		5.2
Tipulidae	0.3			0.1
Other[3]	1.1	2.3		0.4
Plecoptera (stoneflies)				
Perlodidae		1.0		0.3
Nemouridae	15.2	7.9		7.7
Chloroperlidae				
Other[4]		0.5		0.2
Gastropoda[5] (snails)	0.4	0.3		0.2
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult	1.9	6.0	2.5	3.5
Other[6]				
Hemiptera[7] (true bug)		0.4		0.1
Oligochaeta[8] (worms)	2.6	1.2	5.9	4.0
Other[9]	1.5	0.8		
TOTAL	**86.7**	**69.6**	**35.9**	**63.2**

Table 3.91. (cont.)

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=20	n=25	n=6	n=51
Terrestrial invertebrates				
Trichoptera adult	0.4	0.5		0.3
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			20.8	6.9
Other adults[10]		1.9	5.8	2.6
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae		0.7	10.0	3.6
Other[11]				
Hemiptera[12] (true bugs)	0.3	0.4	0.8	0.5
Homoptera				
Cicadellidae	0.4		0.8	0.4
Aphididae	3.8	1.4	20.0	8.4
Cercopidae				
Other[13]	6.0	0.5		2.2
Hymenoptera (bees, wasps, ants)				
Formicidae		3.1	1.7	1.6
Other[14]	1.3	0.5		0.6
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		0.5	4.2	1.6
Lepidoptera	0.3	0.1		0.1
Other [16]	0.3	19.6	0.8	6.9
Total	**12.8**	**28.9**	**64.9**	**35.7**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lyrnnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae. Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.92. Mean annual weight frequencies of prey items consumed by brook trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=20	n=25	n=6	n=51
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	2.3	9.5		3.9
Rhyacophilidae		1.4	2.1	1.2
Limnephilidae	1.0	4.4	20.9	8.8
Brachycentridae	9.7	1.5	<0.1	3.8
Glossosomatidae				
Trichop. pupae				
Other[1]	1.2	0.5		0.6
Ephemeroptera (mayflies)				
Ephemerellidae	3.6	3.7	7.0	4.8
Baetidae	7.3	0.7	1.3	3.1
Heptageniidae	0.3	2.6		1.0
Other[2]	0.7	0.4		0.4
Diptera (flies, midges)				
Chironomidae larvae	11.4	1.0		4.1
Chironomidae pupae	3.9			1.3
Simuliidae	0.4	0.8		0.4
Tipulidae	0.6			0.2
Other[3]	2.4	10.9		4.4
Plecoptera (stoneflies)				
Perlodidae		0.2		<0.1
Nemouridae	1.1	0.5		0.5
Chloroperlidae				
Other[4]		1.8		0.6
Gastropoda[5] (snails)		<0.1		<0.1
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult	6.1	0.6	1.5	2.7
Other[6]				
Hemiptera[7] (true bug)		14.4		4.8
Oligochaeta[8] (worms)	35.5	26.7	0.2	20.8
Other[9]	3.9			1.3
TOTAL	**91.4**	**81.7**	**33.1**	**68.8**

Table 3.92. (cont..)

PREY ORGANISMS	0 + n=20	1 + n=25	2 + n=6	All ages n=51
Terrestrial invertebrates				
Trichoptera adult	0.3	<0.1		0.1
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			7.3	2.4
Other adults[10]			<0.1	<0.1
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae			35.7	11.9
Other[11]		9.4		3.1
Hemiptera[12] (true bugs)	0.1	1.2	<0.1	0.5
Homoptera				
Cicadellidae	1.3		<0.1	0.5
Aphididae	1.3	<0.1	7.1	2.8
Cercopidae				
Other[13]	2.4	<0.1		0.8
Hymenoptera (bees, wasps, ants)		0.2		<0.1
Formicidae		1.7	<0.1	0.6
Other[14]	2.4		0.2	0.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)		4.2	1.2	1.8
Arachnidae				
Lepidoptera	0.2	0.4	15.7	5.4
Other [16]	0.5	1.3		0.6
Total	**8.5**	**18.6**	**67.5**	**31.4**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 **Peltoperlidae,** Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Fotficulidae, Glomerida, Psocidae, Unidentified.

Table 3.93. Mean annual occurrence frequencies of prey items consumed by brook trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=20	n=25	n=6	n=51
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	7.5	11.4		6.3
Rhyacophilidae		6.7	25.0	10.6
Limnephilidae	12.9	35.7	37.5	28.7
Brachycentridae	33.9	32.2	6.3	24.1
Glossosomatidae				
Trichop. pupae				
Other[1]	1.2	3.3		1.5
Ephemeroptera (mayflies)				
Ephemerellidae	19.1	40.6	12.5	24.1
Baetidae	28.3	22.0	25.0	25.1
Heptageniidae	3.3	14.2		5.8
Other[2]	3.3	11.4		4.9
Diptera (flies, midges)				
Chironomidae larvae	55.5	39.5		31.7
Chironomidae pupae	24.2			8.1
Simuliidae	8.1	9.1		5.8
Tipulidae	3.3			1.1
Other[3]	4.4	6.7		3.7
Plecoptera (stoneflies)				
Perlodidae		10.8		3.6
Nemouridae		28.6	35.0	21.2
Chloroperlidae				
Other[4]		6.7		2.2
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult	11.7	32.6	12.5	18.9
Other[6]				
Hemiptera[7] (true bug)		4.2		1.4
Oligochaeta[8] (worms)	8.8	34.8	12.6	13.0
Other[9]	5.9	9.0		5.7

Table 3.93. (cont.)

PREY ORGANISMS	0 + n=20	1 + n=25	2 + n=6	All ages n=51
Terrestrial invertebrates				
Trichoptera adult	3.3	3.3		2.2
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			56.3	18.8
Other adults[10]		4.8	6.3	3.7
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae		3.3	50.0	17.8
Other[11]				
Hemiptera[12] (true bugs)	1.7	2.1		2.3
Homoptera				
Cicadellidae	4.2		6.3	3.5
Aphididae	8.3	10.7	50.0	23.0
Cercopidae				
Other[13]	4.2	1.7		2.0
Hymenoptera (bees, wasps, ants)				
Formicidae		21.3	6.3	9.2
Other[14]	8.3	5.7		4.7
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		4.8	25.0	9.9
Lepidoptera	3.3	2.4	6.3	4.0
Other [16]	3.3	6.7		3.3

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda. Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.94. Mean annual index of relative importance frequencies (IRI) of prey items consumed by brook trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=20	n=25	n=6	n=51
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	2.4	3.5		2.0
Rhyacophilidae		1.4	5.6	2.3
Limnephilidae	2.8	6.4	11.5	6.9
Brachycentridae	11.0	6.7	1.3	6.3
Glossosomatidae				
Trichop. pupae				
Other[1]	0.9	1.4		0.8
Ephemeroptera (mayflies)				
Ephemerellidae	5.3	7.4	4.2	5.6
Baetidae	7.4	4.3	7.0	6.2
Heptageniidae	0.7	2.8		1.2
Other[2]	0.8	1.8		0.9
Diptera (flies, midges)				
Chironomidae larvae	16.1	7.1		7.7
Chironomidae pupae	6.4			2.1
Simuliidae	4.2	4.5		2.9
Tipulidae	0.8			0.3
Other[3]	3.1	3.1	15.1	7.1
Plecoptera (stoneflies)				
Perlodidae		1.8		0.6
Nemouridae	8.3	6.5		4.9
Chloroperlidae				
Other[4]		1.3		0.4
Gastropoda[5] (snails)	1.1	0.4		0.5
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae				
Elmidae adult	3.7	5.9	3.0	4.2
Other[6]				
Hemiptera[7] (true bug)	0.7	2.8		1.2
Oligochaeta[8] (worms)	10.3	9.4	5.6	8.4
Other[9]	2.8	2.5		1.8
TOTAL	88.8	81.0	53.3	74.3

Table 3.94. (cont.)

PREY ORGANISMS	0 + n=20	1 + n=25	2 + n=6	All ages n=51
Terrestrial invertebrates				
Trichoptera adult	0.7	0.5		0.4
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			2.2	0.7
Other adults[10]		2.4		0.8
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae			17.2	5.7
Other[11]		2.0		0.7
Hemiptera[12] (true bugs)		0.9	1.3	0.7
Homoptera				
Cicadellidae	1.1		1.3	0.8
Aphididae	2.5	1.8	13.8	6.0
Cercopidae				
Other[13]		0.6		0.2
Hymenoptera (bees, wasps, ants)				
Formicidae		3.9	1.5	1.8
Other[14]	2.2	0.9		1.0
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae		1.4	5.4	2.3
Lepidoptera	3.8	0.4	4.1	2.8
Other [16]	0.8	4.1		1.6
Total	**11.1**	**18.9**	**46.8**	**25.5**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified. .
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae. Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae. Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, **Machilidae**, Forficulidae, Glomerida, Psocidae, Unidentified.

3.5.3.2 CUTTHROAT TROUT

Table 3.95 lists the number frequency for prey items consumed by cutthroat trout in Tacoma Creek. For 0+ cutthroat trout, Chironomidae larvae and Elmidae larvae had the highest numerical frequency at 33.3 percent each followed by Hydropsychidae and Limnephilidae at 16.7 percent each. For 1+ cutthroat trout, Brachycentridae (22.5%) had the greatest numerical percentage followed by Elmidae adults (15.5%) and Perlodidae (9.7%). For 2+ cutthroat trout, Chironomidae adults (34.2%) had the highest numerical frequency followed by Baetidae (17.1%) and other Diptera adults (14.5%). For all age classes combined, Elmidae larvae at 15.2 percent had the highest numerical percentage followed by Chironomidae larvae at 14.1 percent and Chironomidae adults at 11.4 percent.

Table 3.96 presents the weight frequency for prey items consumed by cutthroat trout in Tacoma Creek. For 0+ cutthroat trout, Hydropsychidae, Limnephilidae, Chironomidae larvae, and Elmidae larvae each had a weight frequency of 25.0 percent. For 1+ cutthroat trout, Hydropsychidae (25.9%) had the highest weight percentage followed by Brachycentridae (16.7%) and Formicidae (9.7%). For 2+ cutthroat trout, Formicidae (39.0%) had the greatest weight frequency followed by Trichoptera adult (29.3%) and other Diptera adults (17.0%). For all age classes combined, Hydropsychidae had the highest weight frequency at 17.0 percent, followed by Formicidae (16.2%) and Elmidae larvae (10.0%).

Table 3.97 lists the occurrence frequencies for prey items consumed by cutthroat trout in Tacoma Creek. For 0+ cutthroat trout, Hydropsychidae, Limnephilidae, Chironomidae larvae, and Elmidae larvae each occurred at 50.0 percent. For 1+ cutthroat trout, Hydropsychidae and Brachycentridae had the highest occurrence frequencies at 58.4 percent each, followed by Ephemerellidae and Chironomidae pupae at 50.0 percent each. For 2+ cutthroat trout, Baetidae and Formicidae had the highest occurrence frequencies at 75.0 percent each, followed by Trichoptera adult and other Hymenoptera at 50.0 percent each. For all age classes combined, Baetidae had the greatest occurrence frequency at 38.9 percent followed by Hydropsychidae and Chironomidae larvae at 36.1 percent each.

Table 3.98 lists the index of relative importance (IRI) for prey items consumed by cutthroat trout in Tacoma Creek. For 0+

Table 3.95. Mean annual number frequencies of prey items consumed by cutthroat trout in Tacoma Creek for 1988.

PREY ORGANISMS	0 + n=2	1 + n=5	2 + n=4	All ages n=11
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	16.7	3.7		6.8
Rhyacophilidae				
Limnephilidae	16.7			5.6
Brachycentridae		22.2	2.5	8.3
Glossosomatidae				
Trichop. pupae				
Other[1]		4.8		1.6
Ephemeroptera (mayflies)				
Ephemerellidae		6.5		2.2
Baetidae		2.7	17.1	6.6
Heptaoeniidae		3.2		1.1
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	33.3	4.2	4.9	14.1
Chironomidae pupae		3.2		1.1
Simuliidae		1.0		0.3
Tipulidae		1.6		0.5
Other[3]				
Plecoptera (stoneflies)				
Perlodidae		9.7		3.2
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	33.3	7.4	4.9	15.2
Elmidae adult		15.5		5.2
Other[6]				
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)				
Other[6]				
TOTAL	100.0	86.0	29.2	71.8

Table 3.95. (cont.)

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=2	n=5	n=4	n=11
Terrestrial invertebrates				
Trichoptera adult			4.9	1.6
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			34.2	11.4
Other adults[10]			14.5	4.8
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae				
Other[11]				
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae				
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		2.7	9.8	4.2
Other[14]			7.3	2.4
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae				
Lepidoptera				
Other [16]		11.5		3.8
Total	**0.0**	**14.2**	**70.7**	**28.2**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomytidae, Mycetophilidae, Tabanidae. Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.96. Mean annual weight frequencies of prey item consumed by cutthroat trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=2	n=5	n=4	n=11
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	25.0	25.9		17.0
Rhyacophilidae				
Limnephilidae	25.0			8.3
Brachycentridae		16.7	2.4	6.4
Glossosomatidae				
Trichop. pupae				
Other[1]		3.6		1.2
Ephemeroptera (mayflies)				
Ephemerellidae		1.8		0.6
Baetidae		2.7	2.4	1.7
Heptageniidae		1.8		0.6
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	25.0	0.9	2.4	9.4
Chironomidae pupae		1.8		0.6
Simuliidae		0.9		0.3
Tipulidae		1.8		0.6
Other[3]				
Plecoptera (stoneflies)				
Perlodidae		1.8		0.6
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	25.0	2.7	2.4	10.0
Elmidae adult		2.7		0.9
Other[6]				
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)				
Other[9]				
TOTAL	**100.0**	**65.1**	**9.6**	**58.2**

Table 3.96. (cont.)

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=2	n=5	n=4	n=11
Terrestrial invertebrates				
Trichoptera adult			29.3	9.8
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			2.4	0.8
Other adults[10]			17.0	5.7
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae				
Other[11]				
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae				
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		9.7	39.0	16.2
Other[14]			2.4	0.8
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae				
Lepidoptera				
Other[16]		25.4		8.5
Total	**0.0**	**35.1**	**90.1**	**41.8**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae. Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.97. Mean annual occurrence frequencies of prey items consumed by cutthroat trout in Tacoma Creek for 1988.

	0+	1 +	2 +	All ages
PREY ORGANISMS	n - 2	n=5	n=4	n=11
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	50.0	58.4		36.1
Rhyacophilidae				
Limnephilidae	50.0			16.7
Brachycentridae		58.4	25.0	27.8
Gbssosomatidae				
Trichop. pupae				
Other[1]		25.0		8.3
Ephemeroptera (mayflies)				
Ephemerellidae		50.0		16.7
Baetidae		41.7	75.0	38.9
Heptageniidae		25.0		8.3
Other2				
Diptera (flies, midges)				
Chironomidae larvae	50.0	33.3	25.0	36.1
Chironomidae pupae		50.0		16.7
Simuliidae		16.7		5.6
Tipulidae		25.0		8.3
Other[3]				
Plecoptera (stoneflies)				
Perlodidae		25.0		8.3
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	50.0	11.3	25.0	28.8
Elmidae adult		9.5		3.2
Other[6]				
Hemiptera[7] (true bug)				
Oligochaeta8 (worms)				
Other[9]				

Table 3.97. (cont.)

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=2	n=5	n=4	n=11
Terrestrial invertebrates				
Trichoptera adult			50.0	16.7
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			25.0	8.3
Other adults[10]			25.0	8.3
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae				
Other[11]				
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae				
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae			75.0	25
Other[14]			50.0	16.7
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae				
Lepidoptera				
Other [16]				

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae. Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

cutthroat trout, Chironomidae larvae and Elmidae larvae had the highest IRI at 29.2 percent each followed by Hydropsychidae and Limnephilidae at 20.1 percent each. For 1+ cutthroat trout, Brachycentridae (12.9%) had the highest IRI followed by Elmidae larvae (11.3%) and Hydropsychidae (10.6%). For 2+ cutthroat trout, Formicidae (19.0%) had the highest IRI, followed by Baetidae (14.5%) and Trichoptera adult and other Diptera adult at 13.0 percent each. For all age classes combined, Elmidae larvae (15.2%) had the greatest IRI followed by Chironomidae larvae (13.2%) and Hydropsychidae (10.2%).

3.5.4 LECLERC CREEK

Stomachs were collected from 32 brown trout, 35 brook trout, 1 cutthroat trout, and 4 mountain whitefish in LeClerc Creek. Prey items consisted of 36 invertebrate families representing 17 orders.

3.5.4.1 BROWN TROUT

Table 3.99 lists the percent composition by number for prey items consumed by brown trout in LeClerc Creek. For 0+ brown trout, Chironomidae larvae, at 34.1 percent, had the highest numerical frequency followed by Ephemerellidae at 11.1 percent and Baetidae at 10.6 percent. For 1+ brown trout, Limnephilidae (23.8%) had the highest numerical percentage followed by Formicidae (15.2%) and Rhyacophilidae (13.7%). For 2+ brown trout, Ephemerellidae (23.6%) had the greatest numerical frequency, followed by Brachycentridae (20.6%) and Limnephilidae (13.0%). For 3+ brown trout, Limnephilidae at 25.0 percent had the highest numerical frequency followed by other Diptera larvae at 11 .1 percent and unidentified Osteichthyes and Formicidae each at 7.2 percent. For 4+ brown trout, Limnephilidae and Brachycentridae had the highest numerical frequency at 19.3 percent each, followed by Lepidoptera at 19.2 percent. For all age classes combined, Limnephilidae (16.4%) had the highest numerical percentage, followed by Brachycentridae (11.4%) and Chironomidae larvae (9.4%).

The percent composition by weight for prey items consumed by brown trout in LeClerc Creek are listed in Table 3.100. For 0+ brown trout, Ephemerellidae had the highest weight frequency at 55.0 percent followed by Lepidoptera at 9.7 percent and Formicidae at 6.8 percent. For 1+ brown trout, Ephemerellidae (35.3%) had the highest weight percent followed by Limnephilidae (25.5%) and Rhyacophilidae (22.8%). For 2+ brown trout, unidentified

Table 3.98. Mean annual index of relative importance frequencies (IRI) of prey items consumed by cutthroat trout in Tacoma Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=2	n=5	n=4	n=11
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	20.1	10.6		10.2
Rhyacophilidae				
Limnephilidae	20.1			6.7
Brachycentridae		12.9	4.6	5.8
Glossosomatidae				
Trichop. pupae				
Other[1]		3.5		1.2
Ephemeroptera (mayflies)				
Ephemerellidae		6.1		2.1
Baetidae		5.6	14.5	6.7
Heptageniidae		3.2		1.1
Other[2]				
Diptera (flies, midges)				
Chironomidae larvae	29.2	5.5	5.0	13.2
Chironomidae pupae		5.8		1.9
Simuliidae		2.7		0.9
Tipulidae		3.0		1.0
Other[3]				
Plecoptera (stoneflies)				
Perlodidae		3.8		1.3
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)				
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	29.2	11.3	5.0	15.2
Elmidae adult		9.5		3.2
Other[6]				
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)				
Other[9]				
TOTAL	98.6	83.5	29.1	70.5

Table 3.98. (cont.)

PREY ORGANISMS	0 + n=2	1 + n=5	2 + n=4	All ages n=11
Terrestrial invertebrates				
Trichoptera adult			13.0	4.3
Diptera (flies, midges)				
Empididae adult				
Chironomidae adults			9.5	3.2
Other adults[10]			13.0	4.3
Coleoptera (beetles)				
Scarabaeidae				
Staphylinidae				
Carabidae				
Other[11]				
Hemiptera[12] (true bugs)				
Homoptera				
Cicadellidae				
Aphididae				
Cercopidae				
Other[13]				
Hymenoptera (bees, wasps, ants)				
Formicidae		6.5	19.0	8.5
Other[14]			9.2	3.1
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae				
Lepidoptera				
Other [16]		10.0		
Total	**0.0**	**16.5**	**69.9**	**28.7**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified,
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.99. Mean annual number frequencies of prey items consumed by brown trout in LeClerc Creek for 1988.

PREY ORGANISM	0 + n=6	1 + n=7	2 + n=10	3 + n=6	4 + n=3	All ages n=32
Aquatic Invertebrates						
Trichoptera (caddisflies)						
Hydropsychidae			0.6			0.1
Rhyacophilidae		13.7	2.6		7.2	4.7
Limnephilidae		23.8	13.0	25.0	19.3	16.4
Brachycentridae		11.7	20.6	5.6	19.3	11.4
Glossosomatidae						
Trichop. pupae						
Other[1]		2.2			2.4	2.9
Ephemeroptera (mayflies)						
Ephemerellidae	11.1	8.2	23.6	1.7	1.2	9.2
Baetidae	10.6	3.4	11.2	1.7	2.4	5.9
Heptageniidae	2.7	1.2	1.2			1.0
Other[2]	5.0	4.4		1.7		2.2
Diptera (flies, midges)						
Chironomidae larvae	34.1	13.0				9.4
Chironomidae pupae						
Simuliidae	5.3	8.3				2.7
Tipulidae					1.2	
Other[3]				11.1		2.2
Plecoptera (stoneflies)						
Perlodidae		1.9	0.6			0.5
Nemouridae						
Chloroperlidae						
Other[4]						
Gastropoda[5] (snails)						
Osteichthyes (fish)						
Salmonidae						
Cottidae			0.9	1.7	7.2	2.0
Unidentified			8.9	7.2	9.6	5.1
Coleoptera (beetles)						
Elmidae larvae			1.6	1.7		0.7
Elmidae adult			5.6	5.6		2.2
Other[6]						
Hemiptera[7] (true bug)						
Oligochaeta[8] (worms)			6.6			1.3
Other[9]	12.5					2.5
TOTAL	**81.3**	**83.5**	**95.4**	**73.0**	**69.8**	**82.4**

Table 3.99. (cont.)

PREY ORGANISMS	0 +	1 +	2 +	3 +	4 +	All ages
	n=6	n=7	n=10	n=6	n=3	n=32
Terrestrial Invertebrates						
Trichoptera adult				1.7	1.2	0.6
Diptera (flies, midges)						
Empididae adult						
Chironomidae adults						
Other adults[10]	8.3		0.9			1.9
Coleoptera (beetles)						
Scarabaeidae						
Staphylinidae					1.2	0.2
Carabidae				1.7		0.3
Other[11]			0.5		1.2	0.3
Hemiptera[12] (true bugs)						
Homoptera						
Cicadellidae				5.6		1.1
Aphididae						
Cercopidae						
Other[13]						
Hymenoptera (bees, wasps, ants)						
Formicidae	5.0	15.2	1.6	7.2	3.7	6.5
Other[14]				5.6	1.2	1.3
Orthoptera[15] (grasshoppers)						
Araneida (spiders, mites)						
Arachnidae				5.6		1.1
Lepidoptera	2.5		2.7		19.2	4.1
Other[16]	2.8				1.2	0.8
Total	**18.6**	**15.2**	**4.4**	**27.4**	**28.9**	**18.2**

1 Hydroptilidae. Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae. Unidentified.
6 Dytiscidae. Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea. Nematoda, Gammaridae, Hydracarina. Astacidae Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae. Sciaridae, Sibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae. Unidentified.
12 Nabidae. Pentatomidae. Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae. Unidentified.

Osteichthyes (28.0%) had the highest weight frequency followed by Cottidae (24.3%) and Oligochaeta (23.6%). For 3+ brown trout, unidentified Osteichthyes had the greatest weight frequency at 29.4 percent followed by Limnephilidae (25.0%) and Cottidae (20.0%). For 4+ brown trout, unidentified Osteichthyes (45.2%) had the greatest weight percentage followed by Limnephilidae (27.5%) and Cottidae (13.5%). For all age classes combined, unidentified Osteichthyes (20.0%) had the highest weight frequency, followed by Ephemerellidae (19.6%) and Limnephilidae (16.4%).

Table 3.101 lists the frequency of occurrence for prey items consumed by brown trout in LeClerc Creek. For 0+ brown trout, Chironomidae larvae had the highest occurrence frequency at 62.5 percent followed by Ephemerellidae at 41.7 percent and Baetidae, other Ephemeroptera, Simuliidae, Formicidae, and Lepidoptera at 25.0 percent each. For 1+ brown trout, Ephemeroptera and Formicidae at 50.0 percent each had the highest occurrence frequencies followed by Brachycentridae at 41.7 percent. For 2+ brown trout, Ephemerellidae (66.7%) had the highest occurrence frequency followed by Baetidae (50.0%) and Limnephilidae and unidentified Osteichthyes at 33.3 percent each. For 3+ brown trout, unidentified Osteichthyes and Formicidae had the highest occurrence frequencies at 33.3 percent each, followed by Limnephilidae, Brachycentridae, Elmidae adult, Cicadellidae, and Arachnidae at 25.0 percent each. For 4+ brown trout, Limnephilidae, unidentified Osteichthyes, and Lepidoptera had occurrence frequencies of 100 percent each. For all age classes combined, Limnephilidae (39.2%) occurred most frequently followed by Ephemerellidae (38.3%) and unidentified Osteichthyes (33.3%).

Table 3.102 lists the index of relative importance (IRI) for prey items consumed by brown trout in LeClerc Creek. For 0+ brown trout, Chironomidae larvae had the highest IRI at 22.7 percent, followed by Ephemerellidae at 22.4 percent and Baetidae at 6.9 percent. For 1+ brown trout, Rhyacophilidae (23.0%) had the highest IRI followed by Limnephilidae (15.9%) and Brachycentridae (12.5%). For 2+ brown trout, Ephemerellidae (17.7%) had the highest IRI followed by unidentified Osteichthyes (13.3%) and Baetidae (10.5%). For 3+ brown trout, Limnephilidae (25.0%) had the highest IRI followed by unidentified Osteichthyes (11.5%) and Cicadellidae (8.9%). For 4+ brown trout, unidentified Osteichthyes (15.5%) had the greatest IRI, followed by Limnephilidae (14.5%) and Lepidoptera (13.3%). For all ages of brown trout combined, Limnephilidae at 12.7

Table 3.100. Mean annual weight frequencies of prey items consumed by brown trout in LeClerc Creek for 1988.

PREY ORGANISMS	0 + n=6	1 + n=7	2 + n=10	3 + n=6	4 + n=3	All ages n=32
Aquatic invertebrates						
Trichoptera (caddisflies)						
Hydropsychidae			<0.1			<0.1
Rhyacophilidae		22.8	1.4		<0.1	4.8
Limnephilidae		25.5	4.2	25.0	27.5	16.4
Brachycentridae		4.4	1.5	1.4	4.4	2.3
Glossosomatidae						
Trichop. pupae						
Other[1]		0.4		0.1	0.2	0.1
Ephemeroptera (mayflies)						
Ephemerellidae	55.0	35.3	7.1	0.5	0.3	19.6
Baetidae	2.1	0.6	2.5	0.1	<0.1	1.1
Heptageniidae	3.3	1.6	0.2			1.1
Other[2]	4.7	2.0		0.7		1.5
Diptera (flies, midges)						
Chironomidae larvae	5.1	0.2				1.1
Chironomidae pupae						
Simuliidae	2.1		0.5			0.6
Tipulidae					0.5	
Other[3]				10.1		2.0
Plecoptera (stoneflies)						
Perlodidae		1.5	1.2			0.6
Nemouridae						
Chloroperlidae						
Other[4]						
Gastropoda[5] (snails)						
Osteichthyes (fish)						
Salmonidae						
Cottidae			24.3	20.0	13.5	11.6
Unidentified			28.0	29.4	45.2	20.0
Coleoptera (beetles)						
Elmidae larvae			0.2	0.3		0.1
Elmidae adult			0.1	0.1		<0.1
Other[6]						
Hemiptera[7] (true bug)						
Oligochaeta[8] (worms)			23.6			4.7
Other[9]	3.9				<.01	0.8
TOTAL	76.2	91.0	94.8	87.7	91.6	88.5

Table 3.100. (cont.)

	0 +	1 +	2 +	3 +	4 +	All ages
PREY ORGANISMS	n=6	n=7	n=10	n=6	n=3	n=32
Terrestrial Invertebrates						
Trichoptera adult				<0.1	0.8	0.2
Diptera (flies, midges)						
Empididae adult						
Chironomidae adults						
Other adults[10]	3.3		<0.1			0.7
Coleoptera (beetles)						
Scarabaeidae						
Staphylinidae					<0.1	<0.1
Carabidae				1.3		0.3
Other[11]			0.5		0.2	0.1
Hemiptera[12] (true bugs)				5.6	0.2	1.1
Homoptera						
Cicadellidae				5.6		1.1
Aphididae						
Cercopidae						
Other[13]						
Hymenoptera (bees, wasps, ants)						
Formicidae	6.8	9.0	0.3	0.1	0.4	3.6
Other[14]						
Orthoptera[15] (grasshoppers)						
Araneida (spiders, mites)						
Arachnidae				0.3		0.1
Lepidoptera	9.7		3.0		6.8	3.9
Other[16]	3.3					0.7
Total	**23.1**	**9.0**	**3.8**	**12.9**	**8.4**	**11.8**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae. Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae. Empididae. Muscidae. Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae. Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae. Sciaridae, Bibionidae, Pharidae, Dryomyzidae. Dolichopodidae. Dixidae. Stratiomyidae. Unidentified.
11 Cerambycidae. Pselaphidae, Curculionidae. Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae. Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.101. Mean annual occurence frequencies of prey items consumed by brown trout in LeClerc Creek for 1988.

PREY ORGANISMS	0 + n=6	1 + n=7	2 + n=10	3 + n=6	4 + n=3	All ages n=32
Aquatic Invertebrates						
Trichoptera (caddisflies)						
Hydropsychidae			8.3			1.7
Rhyacophilidae		37.5	25.0		50.0	22.5
Limnephilidae		37.5	33.3	25.0	100.0	39.2
Brachycentridae		41.7		25.0		13.3
Glossosomatidae						
Trichop. pupae						
Other[1]		6.3		8.4	25.0	7.9
Ephemeroptera (mayflies)						
Ephemerellidae	41.7	50.0	66.7	8.3	25.0	38.3
Baetidae	25.0	33.3	50.0	8.3	25.0	28.3
Heptageniidae	16.7	8.3	8.3			6.7
Other[2]	25.0	25.0		8.3		11.7
Diptera (flies, midges)						
Chironomidae larvae	62.5	25.0				17.5
Chironomidae pupae						
Simuliidae	25.0		25.0			10.0
Tipulidae					25.0	5.0
Other[3]						
Plecoptera (stoneflies)						
Perlodidae		12.5				2.5
Nemouridae						
Chloroperlidae						
Other[4]				25.0		5.0
Gastropoda[5] (snails)						
Osteichthyes (fish)						
Salmonidae						
Cottidae			8.3	8.3	50.0	13.3
Unidentified			33.3	33.3	100.0	33.3
Coleoptera (beetles)						
Elmidae larvae			16.7	8.3		5.0
Elmidae adult			8.3	25.0		6.7
Other[6]						
Hemiptera[7] (true bug)						
Oligochaeta[8] (worms)			16.7			3.3
Other[9]	12.5				12.5	5.0

Table 3.101. (cont.)

	0 +	1 +	2 +	3 +	4 +	All ages
PREY ORGANISMS	n=6	n=7	n=10	n=6	n=3	n=32
Terrestrial Invertebrates						
Trichoptera adult				8.3	25.0	6.7
Diptera (flies, midges)						
Empididae adult						
Chironomidae adults						
Other adults[10]	8.3		4.2			5.0
Coleoptera (beetles)						
Scarabaeidae						
Staphylinidae					25.0	5.0
Carabidae				8.3		1.7
Other[11]			8.3		25.0	6.7
Hemiptera[12] (true bugs)						
Homoptera						
Cicadellidae				25.0		5.0
Aphididae						
Cercopidae						
Other[13]						
Hymenoptera (bees, wasps, ants)						
Formicidae	25.0	50.0	8.3	33.3	25.0	28.3
Other[14]						
Orthoptera[15] (grasshoppers)						
Araneida (spiders, mites)						
Arachnidae				25.0		50.0
Lepidoptera	25.0				100.0	25.0
Other [16]	16.7					3.3

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae. Muscidae, Tabanidae. Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae. Planorbidae, Physidae. Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
6 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina. Astacidae. Sphaeriidae, Cypridae.
1 0 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
1 1 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
1 2 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae. Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
1 5 Acrididae, Tetrigidae.
16 Sminthuridae. Entomobryidae. Chrysopidae. Machilidae. Forficulidae. Glomerida. Psocidae. Unidentified.

Table 3.102. Mean annual index of relative importance frequencies (IRI) of prey items consumed by brown trout in LeClerc Creek for 1988.

PREY ORGANISMS	0 +	1 +	2 +	3 +	4 +	All ages
	n=6	n=7	n=10	n=6	n=3	n=32
Aquatic invertebrates						
Trichoptera (caddisflies)						
Hydropsychidae			1.3			0.3
Rhyacophilidae		23.0	4.8		7.4	7.0
Limnephilidae		15.9	8.2	25.0	14.5	12.7
Brachycentridae		12.5	9.1	5.0	12.7	7.9
Glossosomatidae						
Trichop. pupae						
Other[1]		5.3		4.7	8.4	3.6
Ephemeroptera (mayflies)						
Ephemerellidae	22.4	7.3	17.7	1.9	2.3	10.3
Baetidae	6.9	7.6	10.5		2.3	5.5
Heptageniidae	5.3	2.3	1.5	1.8		2.2
Other[2]	5.8	5.8		1.9		2.7
Diptera (flies, midges)						
Chironomidae larvae	22.7	7.4				6.0
Chironomidae pupae						
Simuliidae	6.0		6.8			2.6
Tipulidae					2.2	0.4
Other[3]				7.2		1.4
Plecoptera (stoneflies)						
Perlodidae		3.6	1.5			1.0
Nemouridae						
Chloroperlidae						
Other[4]						
Gastropoda[5] (snails)						
Osteichthyes (fish)						
Salmonidae						
Cottidae			6.7	5.3	8.9	4.2
Unidentified			13.3	11.5	15.5	8.0
Coleoptera (beetles)						
Elmidae larvae			2.8	1.8		0.9
Elmidae adult			1.4	4.8		1.2
Other[6]						
Hemiptera[7] (true bug)						
Oligochaeta[8] (worms)			6.3			1.3
Other[9]	6.9				2.2	1.8
TOTAL	**76.0**	**90.7**	**91.9**	**70.9**	**70.2**	**80.9**

Table 3.102. (cont.)

PREY ORGANISMS	0 +	1 +	2 +	3 +	4 +	All ages
	n=6	n=7	n=10	n=6	n=3	n=32
Terrestrial invertebrates						
Trichoptera adult				1.8	4.3	1.2
Diptera (flies, midges)						
Empididae adult						
Chironomidae adults						
Other adults[10]	6.5		1.8		2.2	2.1
Coleoptera (beetles)						
Scarabaeidae						
Staphylinidae					2.2	0.4
Carabidae				2.0		0.4
Other[11]			1.4		2.2	0.7
Hemiptera[12] (true bugs)				5.8	2.2	1.6
Homoptera						
Cicadellidae				8.9		1.8
Aphidida						
Cercopidae						
Other[13]						
Hymenoptera (bees, wasps, ants)						
Formicidae	6.1	7.3	1.5	6.6	2.4	4.8
Other[14]						
Orthoptera[15] (grasshoppers)						
Araneida (spiders, mites)						
Arachnidae				4.8		1.0
Lepidoptera	6.2		3.4		13.3	4.6
Other[16]	5.3					1.1
Total	**24.1**	**7.3**	**8.1**	**29.9**	**28.8**	**19.8**

1 Hydroptilidae, Leoidostomatidae. Leotoceridae. Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae. Syrphidae.
4 Peltoperlidae. Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae. Haliplidae. Amphizoidae. Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculldae, Naididae.
9 Pyralidae, Fish eggs, Hirudinae, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae. Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curuclionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae. Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae. Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

percent had the highest IRI, followed by Ephemerellidae (10.3%) and unidentified Osteichthyes (8.0%).

3.5.4.2 BROOK TROUT

Table 3.103 lists the percent composition by number for prey items consumed by brook trout in LeClerc Creek. For 0+ brook trout, Chironomidae larvae (52.2%) had the highest number frequency followed by Simuliidae (8.3%) and Brachycentridae (7.5%). For 1+ brook trout, Brachycentridae had the highest numerical frequency at 19.9 percent, followed by Limnephilidae at 17.5 percent and Lepidoptera at 11.6 percent. For 2+ brook trout, Limnephilidae (52.2%) had the greatest numerical percentage followed by Empididae adult (6.8%) and other Hymenoptera (5.4%). For all age classes of brook trout combined, Chironomidae larvae (24.6%) had the highest numerical frequency followed by Lirnnephilidae (24.5%) and Brachycentridae (10.6%).

The percent composition by weight for prey items consumed by brook trout in LeClerc Creek is presented in Table 3.104. For 0+ brook trout, Chironomidae larvae at 27.7 percent had the highest weight frequency followed by Simuliidae at 25.0 percent and Limnephilidae at 9.9 percent. For 1+ brook trout, Lepidoptera (23.0%) had the highest weight percentage followed by Limnephilidae (21.3%) and Brachycentridae (8.0%). For 2+ brook trout, Brachycentridae (49.4%) had the highest weight frequency followed by other Hymenoptera (8.6%) and Limnephilidae (2.0%). For all age classes combined, Brachycentridae (21.9%) had the greatest weight frequency followed by Limnephilidae (11 .1%) and Chironomidae larvae (10.8%).

Table 3.105 lists the frequency of occurrence for prey items consumed by brook trout in LeClerc Creek. For 0+ brook trout, Chironomidae larvae had the highest occurrence frequency at 80.8 percent followed by Simuliidae at 50.0 percent and Brachycentridae at 27.5 percent. For 1+ brook trout, Chironomidae larvae (52.9%) had **the highest occurrence followed by Brachycentridae and** Lepididoptera at 44.4 percent each. For 2+ brook trout, Limnephilidae had the highest occurrence at 100 percent followed by Brachycentridae and Chironomidae larvae at 50.0 percent each. For all age classes combined, Chironomidae larvae (61.2%) had the highest occurrence frequency, followed by Limnephilidae (56.1%) and Brachycentridae (40.6%).

Table 3.103. Mean annual number frequencies of prey items consumed by brook trout in LeClerc Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=12	n=18	n=5	n=35
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	0.2			0.1
Rhyacophilidae		2.2		0.7
Limnephilidae	3.9	17.5	52.2	24.5
Brachycentridae	7.5	19.9	4.5	10.6
Glossosomatidae			1.2	0.4
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	0.6	1.7		0.7
Baetidae	3.1	10.4	1.2	4.9
Heptageniidae		0.6		0.2
Other[2]		0.3		0.1
Diptera (flies, midges)				
Chironomidae larvae	52.2	16.9	5.1	24.6
Chironomidae pupae				
Simuliidae	8.3	0.6		3.0
Tipulidae				
Other[3]				
Plecoptera (stoneflies)				
Perlodidae			1.2	0.4
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		0.3		0.1
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified		0.3		0.1
Coleoptera (beetles)				
Elmidae larvae	0.2	0.5	0.7	0.5
Elmidae adult	2.0	1.8	0.7	1.5
Other[6]		2.5		0.8
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)		0.3	0.7	0.3
Other[9]	2.4		2.1	1.5
TOTAL	**80.4**	**75.8**	**69.6**	**75.0**

Table 3.103. (cont.)

PREY ORGANISMS	0 + n=12	1 + n=18	2 + n=5	All ages n=35
Terrestrial invertebrates				
Trichoptera adult	0.7	3.5		1.4
Diptera (flies, midges)				
Empididae adult	3.1	0.3	6.8	3.4
Chironomidae adults				
Other adults[10]			0.7	0.2
Coleoptera (beetles)				
Scarabaeidae		0.6		0.2
Staphylinidae				
Carabidae		2.0		0.6
Other[11]				
Hemiptera[12] (true bugs)			0.7	0.2
Homoptera				
Cicadellidae	0.2	0.3		0.2
Aphididae	2.6		2.8	1.8
Cercopidae		2.0	0.6	0.9
Other[13]		0.8		0.3
Hymenoptera (bees, wasps, ants)				
Formicidae	3.2	0.8	0.7	1.6
Other[14]	1.1		5.4	2.2
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	0.4	2.0		0.8
Lepidoptera		11.6	0.6	4.1
Other [16]	8.4		11.6	6.7
Total	**19.7**	**23.9**	**29.9**	**24.6**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3. Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Hatiplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
6 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae. Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae. Unidentified.

Table 3.104. Mean annual weight frequencies of prey items consumed by brook trout in LeClerc Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=12	n=18	n=5	n=35
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	1.2			0.4
Rhyacophilidae		7.0		2.3
Limnephilidae	9.9	21.3	2.0	11.1
Brachycentridae	8.3	8.0	49.4	21.9
Glossosomatidae			<0.1	<0.1
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	1.6	6.3		2.6
Baetidae	2.6	6.3	0.1	3.0
Heptageniidae		0.6		0.2
Other[2]		2.1		0.7
Diptera (flies, midges)				
Chironomidae larvae	27.7	4.7	0.1	10.8
Chironomidae pupae				
Simuliidae	25.0	<0.1		8.4
Tipulidae				
Other[3]				
Plecoptera (stoneflies)				
Perlodidae			0.4	0.4
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		2.3		0.8
Osteichthyes (fish)				
Salmonidae				
Cottidae				
Unidentified		0.4		0.1
Coleoptera (beetles)				
Elmidae larvae	0.1	0.8	0.1	0.3
Elmidae adult	0.9	3.2	0.1	1.4
Other[6]		0.9		0.3
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)		3.0	0.1	1.0
Other[9]	0.1			0.1
TOTAL	77.4	67.0	52.3	65.8

Table 3.104. **(cont.)**

PREY ORGANISMS	0 + n=12	1 + n=18	2 + n=5	All ages n=35
Terrestrial invertebrates				
Trichoptera adult	0.6	3.3		1.3
Diptera (flies, midges)				
Empididae adult	4.1	<0.1	1.4	1.8
Chironomidae adults				
Other adults[10]				
Coleoptera (beetles)				
Scarabaeidae		0.2		0.1
Staphylinidae				
Carabidae		0.1		<0.1
Other[11]				
Hemiptera[12] (true bugs)			0.1	<0.1
Homoptera				
Cicadellidae	0.1	<0.1		0.1
Aphididae	0.6	2.9	0.1	1.2
Cercopidae		<0.1	1.4	0.5
Other[13]		0.2		0.1
Hymenoptera (bees, wasps, ants)				
Formicidae	2.3	0.8	0.7	1.3
Other[14]	0.3		8.6	2.9
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	0.1	1.2		0.4
Lepidoptera		23.0	1.7	8.2
Other [16]	14.0		33.3	15.8
Total	122.1	31.7	147.3	33.7

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
6 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified,
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.105. Mean annual occurence frequencies of prey items consumed by brook trout in LeClerc Creek for 1988.

	0 +	1 +	2 +	All ages
PREY ORGANISMS	n=12	n=18	n=5	n=35
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	4.2			1.4
Rhyacophilidae		38.9		13.0
Limnephilidae	26.7	41.7	100	56.1
Brachycentridae	27.5	44.4	5.0	40.6
Glossosomatidae			12.5	4.2
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	5.0	8.3		4.4
Baetidae	10.0	19.4	12.5	13.3
Heptageniidae		11.1		3.7
Other[2]		8.3		2.8
Diptera (flies, midges)				
Chironomidae larvae	80.8	52.9	50	61.2
Chironomidae pupae				
Simuliidae	50.0	5.6		18.5
Tipulidae				
Other[3]				
Plecoptera (stoneflies)				
Perlodidae			12.5	4.2
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		2.8		.9
Osteichthyes (fish)		2.8		.9
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	4.2	8.3	12.5	8.3
Elmidae adult	13.3	27.8	12.5	17.9
Other[6]		8.3		2.8
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)		1.4	6.3	2.6
Other[9]	16.7		12.5	9.7

Table 3.105. (cont.)

PREY ORGANISMS	0 + n=12	1 + n=18	2 + n=5	All ages n=35
Terrestrial invertebrates				
Trichoptera adult	12.5	19.4		10.6
Diptera (flies, midges)				
Empididae adult	16.7	2.8	12.5	10.7
Chironomidae adults			12.5	
Other adults[10]				
Coleoptera (beetles)				
Scarabaeidae		5.6		1.9
Staphylinidae				
Carabidae		11.1		3.7
Other[11]				
Hemiptera[12] (true bugs)			12.5	4.2
Homoptera				
Cicadellidae	4.2	2.8		2.3
Aphididae	21.7	11.1	12.5	15.1
Cercopidae		2.8	12.5	5.1
Other[13]		8.3		2.8
Hymenoptera (bees, wasps, ants)				
Formicidae	18.3	5.1	12.5	12.1
Other[14]	2.8		12.5	5.1
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	4.2	19.4		7.9
Lepidoptera		44.4	12.5	19.0
Other[16]	12.5		13.3	7.7

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea. Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.106 lists the index of relative importance (IRI) for prey items consumed by brook trout in LeClerc Creek. For 0+ brook trout, Chironomidae larvae had the highest IRI at 34.8 percent, followed by Simuliidae at 20.8 percent and Brachycentridae at 6.4 percent. For 1+ brook trout, Limnephilidae (15.9%) had the greatest IRI followed by Lepidoptera (13.7%) and Chironomidae larvae (11.8%). For 2+ brook trout, Limnephilidae (30.8%) had the highest IRI followed by Brachycentridae (28.5%) and Chironomidae larvae (6.0%). For all age classes combined, Chironomidae larvae (17.5%) had the greatest IRI followed by Limnephilidae (17.4%) and Brachycentridae (14.9%).

3.5.4.3 CUTTHROAT TROUT

Only one 2+ cutthroat trout was captured in LeClerc Creek. Empididae adults, at 22.0 percent, had the highest numerical frequency for consumed prey items followed by Formicidae at 19.5 percent and other Hymenoptera at 12.2 percent (Table 3.107). Other Hymenoptera (7.8%) had the highest weight percentage followed by Empididae adults (4.7%) and Elmidae adults (2.5%) (Table 3.108). All prey items consumed by the 2+ cutthroat trout had an occurrence frequency of 100 percent (Table 3.109). Other Hymenoptera at 12.9 percent had the highest index of relative importance (IRI) followed by Empididae adults at 7.4 percent and Formicidae at 7.1 percent (Table 3.110).

3.5.4.4 MOUNTAIN WHITEFISH

Table 3.111 lists the percent composition by number for prey items consumed by 3+ and 4+ mountain whitefish in LeClerc Creek. For 3+ mountain whitefish, Limnephilidae had the highest number frequency at 84.5 percent, followed by Baetidae at 5.1 percent and Brachycentridae at 4.4 percent. For 4+ mountain whitefish, Simuliidae had the highest number frequency at 90.5 percent, followed by Limnephilidae at 6.9 percent and Rhyacophilidae at 1.5 percent. For both age classes combined, Limnephilidae (45.7%) had the highest numerical percent followed by Simuliidae (45.3%) and Baetidae (2.7%).

Table 3.112 lists the percent composition by weight for prey items consumed by 3+ and 4+ mountain whitefish in LeClerc Creek. For 3+ mountain whitefish, Limnephilidae had the highest weight frequency at 96.2 percent, followed by Hydropsychidae (1.1%) and Ephemerellidae (0.8%). For 4+ mountain whitefish, Rhyacophilidae

Table 3.106. Mean annual index of relative importance (IRI) of prey items consumed by brook trout in LeClerc Creek for 1988.

PREY ORGANISMS	0 + n=12	1 + n=18	2 + n=5	All ages n=35
Aquatic invertebrates				
Trichoptera (caddisflies)				
Hydropsychidae	0.6			0.2
Rhyacophilidae		4.9		1.6
Limnephilidae	5.5	15.9	30.8	17.4
Brachycentridae	6.4	9.8	28.5	14.9
Glossosomatidae			1.6	0.5
Trichop. pupae				
Other[1]				
Ephemeroptera (mayflies)				
Ephemerellidae	1.2	2.8		1.3
Baetidae	3.4	8.5		4.0
Heptageniidae		1.8		0.6
Other[2]		1.6		0.5
Diptera (flies, midges)				
Chironomidae larvae	34.8	11.8	6.0	17.5
Chironomidae pupae				
Simuliidae	20.8	0.9		7.2
Tipulidae				
Other[3]			1.3	0.4
Plecoptera (stoneflies)				
Perlodidae				
Nemouridae				
Chloroperlidae				
Other[4]				
Gastropoda[5] (snails)		0.8		0.3
Osteichthyes (fish)		0.5		0.2
Salmonidae				
Cottidae				
Unidentified				
Coleoptera (beetles)				
Elmidae larvae	0.6	1.7	1.3	1.2
Elmidae adult	2.1	5.1	1.3	2.8
Other[6]		2.6		0.9
Hemiptera[7] (true bug)				
Oligochaeta[8] (worms)		0.9	1.3	0.7
Other[9]	2.1		1.3	1.1
TOTAL	77.5	69.6	71.8	73.3

Table 3.106. (cont.)

PREY ORGANISMS	0 + n=12	1 + n=18	2 + n=5	All ages n=35
Terrestrial invertebrates				
Trichoptera adult	1.5	5.9		2.5
Diptera (flies, midges)				
Empididae adult	2.5	0.4	3.5	2.1
Chironomidae adults				
Other adults[10]				
Coleoptera (beetles)				
Scarabaeidae		1.0		0.3
Staphylinidae				
Carabidae		1.9		0.6
Other[11]				
Hemiptera[12] (true bugs)			1.3	0.4
Homoptera				
Cicadellidae	0.6	0.4		0.3
Aphididae	3.0		1.6	1.5
Cercopidae		2.0	1.6	1.2
Other[13]		2.0		0.7
Hymenoptera (bees, wasps, ants)				
Formicidae	3.3	1.0	1.3	1.9
Other[14]	1.1		5.4	2.2
Orthoptera[15] (grasshoppers)				
Araneida (spiders, mites)				
Arachnidae	0.5	3.3		1.3
Lepidoptera		13.7	1.9	5.2
Other[16]	9.9		10.6	6.8
Total	**22.4**	**31.6**	**27.2**	**27.0**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.n
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.107. Mean annual number fequencies of prey items consumed by cutthroat trout in LeClerc Creek for 1988.

PREY ORGANISMS	2 + n=1
Aquatic invertebrates	
Trichoptera (caddisflies)	
Hydropsychidae	
Rhyacophilidae	
Limnephilidae	
Brachycentridae	
Glossosomatidae	
Trichop. pupae	
Other[1]	
Ephemeroptera (mayflies)	
Ephemerellidae	7.3
Baetidae	
Heptageniidae	
Other[2]	
Diptera (flies, midges)	
Chironomidae larvae	
Chironomidae pupae	
Simuliidae	
Tipulidae	
Other3	
Plecoptera (stoneflies)	
Perlodidae	
Nemouridae	
Chloroperlidae	
Other4	
Gastropoda[5] (snails)	
Osteichthyes (fish)	
Salmonidae	
Cottidae	
Unidentified	
Coleoptera (beetles)	
Elmidae larvae	
Elmidae adult	2.4
Other[6]	
Hemiptera[7] (true bug)	
Oligochaeta[8] (worms)	
Other[9]	2.4
TOTAL	**12.1**

Table 3.107. (cont.)

	2 +
PREY ORGANISMS	n=1
Terrestrial invertebrates	
Trichoptera adult	2.4
Diptera (flies, midges)	
Empididae adult	22.0
Chironomidae adults	
Other adults[10]	2.4
Coleoptera (beetles)	
Scarabaeidae	
Staphylinidae	
Carabidae	
Other[11]	
Hemiptera[12] (true bugs)	
Homoptera	
Cicadellidae	
Aphididae	7.3
Cercopidae	
Other[13]	
Hymenoptera (bees, wasps, ants)	
Formicidae	19.5
Other[14]	12.2
Orthoptera[15] (grasshoppers)	
Araneida (spiders, mites)	
Arachnidae	2.4
Lepidoptera	
Other [16]	19.5
Total	**87.7**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
g Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
1 0 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
1 1 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
1 2 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
1 4 lchneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida. Psocidae. Unidentified.

Table 3.108. Mean annual weight frequencies of prey items consumed by cutthroat trout in LeClerc Creek for 1988.

	2 +
PREY ORGANISMS	n=1
Aquatic invertebrates	
Trichoptera (caddisflies)	
Hydropsychidae	
Rhyacophilidae	
Limnephilidae	
Brachycentridae	
Glossosomatidae	
Trichop. pupae	
Other[1]	
Ephemeroptera (mayflies)	
Ephemerellidae	1.7
Baetidae	
Heptageniidae	
Other[2]	
Diptera (flies, midges)	
Chironomidae larvae	
Chironomidae pupae	
Simuliidae	
Tipulidae	
Other[3]	
Plecoptera (stoneflies)	
Perlodidae	
Nemouridae	
Chloroperlidae	
Other[4]	
Gastropoda[5] (snails)	
Osteichthyes (fish)	
Salmonidae	
Cottidae	
Unidentified	
Coleoptera (beetles)	
Elmidae larvae	
Elmidae adult	2.5
Other[6]	
Hemiptera[7] (true bug)	
Oligochaeta[8] (worms)	
Other[9]	1.9
TOTAL	**6.2**

Table 3.108. (cont.)

PREY ORGANISMS	2+ n=1
Terrestrial invertebrates	
Trichoptera adult	0.1
Diptera (flies, midges)	
Empididae adult	4.7
Chironomidae adults	
Other adults[10]	2.0
Coleoptera (beetles)	
Scarabaeidai	
Staphylinidae	
Carabidae	
Other[11]	0.1
Hemiptera[12] (true bugs)	
Homoptera	
Cicadellidae	
Aphididae	0.1
Cercopidae	
Other[13]	
Hymenoptera (bees, wasps, ants)	
Formicidae	2.0
Other[14]	7.8
Orthoptera[15] (grasshoppers)	
Araneida (spiders, mites)	
Arachnidae	0.1
Lepidoptera	
Other [16]	77.0
Total	**93.8**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae. Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.109. Mean annual occurence freqencies of prey items consumed by cutthroat trout in LeClerc Creek for 1988.

	2+
PREY ORGANISMS	n=1
Aquatic invertebrates	
Trichoptera (caddisflies)	
Hydropsychidae	
Rhyacophilidae	
Limnephilidae	
Brachycentridae	
Glossosomatidae	
Trichop. pupae	
Other[1]	
Ephemeroptera (mayflies)	
Ephemerellidae	100.0
Baetidae	
Heptageniidae	
Other[2]	
Diptera (flies, midges)	
Chironomidae larvae	
Chironomidae pupae	
Simuliidae	
Tipulidae	
Other[3]	
Plecoptera (stoneflies)	
Perlodidae	
Nemouridae	
Chloroperlidae	
Other[4]	
Gastropoda[5] (snails)	
Osteichthyes (fish)	
Salmonidae	
Cottidae	
Unidentified	
Coleoptera (beetles)	
Elmidae larvae	
Elmidae adult	100.0
Other6	
Hemiptera[7] (true bug)	
Oligochaeta[8] (worms)	
Other[9]	100.0

Table 3.109. (cont.)

PREY ORGANISMS	2 + n=1
Terrestrial invertebrates	
Trichoptera adult	100.0
Diptera (flies, midges)	
Empididae adult	100.0
Chironomidae adults	
Other adults[10]	100.0
Coleoptera (beetles)	
Scarabaeidae	
Staphylinidae	
Carabidae	
Other[11]	100.0
Hemiptera[12] (true bugs)	
Homoptera	
Cicadellidae	
Aphididae	100.0
Cercopidae	
Other[13]	
Hymenoptera (bees, wasps, ants)	
Formicidae	100.0
Other[14]	100.0
Orthoptera[15] (grasshoppers)	
Araneida (spiders, mites)	
Arachnidae	100.0
Lepidoptera	
Other [16]	100.0

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae. Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.110. Mean annual index of relative importance frequencies (IRI) of prey items consumed by cutthroat trout in LeClerc Creek for 1988.

PREY ORGANISMS	2+ n=1
Aquatic invertebrates	
Trichoptera (caddisflies)	
Hvdroosvchidae	
Rhyacophilidae	
Limnephilidae	
Brachycentridae	
Glossosomatidae	
Trichop. pupae	
Other[1]	
Ephemeroptera (mayflies)	
Ephemerellidae	6.4
Baetidae	
Heptageniidae	
Other[2]	
Diptera (flies. midaes)	
Chironomidae larvae	
Chironomidae pupae	
Simuliidae	
Tipulidae	
Other[3]	
Plecoptera (stoneflies)	
Perlodidae	
Nemouridae	
Chloroperlidae	
Other[4]	
Gastropoda[5] (snails)	
Osteichthyes (fish)	
Salmonidae	
Cottidae	
Unidentified	
Coleoptera (beetles)	
Elmidae larvae	
Elmidae adult	6.2
Other6	
Hemiptera[7] {true bug)	
Oligochaeta[8] (worms)	
Other[9]	6.1
TOTAL	24.7

Table 3.110. (cont.)

PREY ORGANISMS	2 + n=1
Terrestrial invertebrates	
Trichoptera adult	6.0
Diptera (flies, midges)	
Empididae adult	7.4
Chironomidae adults	
Other adults[10]	6.1
Coleoptera (beetles)	
Scarabaeidae	
Staphylinidae	
Carabidae	
Other[11]	6.0
Hemiptera[12] (true bugs)	
Homoptera	
Cicadellidae	
Aphididae	6.3
Cercopidae	
Other[13]	
Hymenoptera (bees, wasps, ants)	
Formicidae	7.1
Other[14]	12.9
Orthoptera[15] (grasshoppers)	
Araneida (spiders, mites)	
Arachnidae	6.0
Lepidoptera	
Other [16]	23.3
Total	**75.1**

1 Hydroptilidae, Lepidostomatidae. Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae. Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae. Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.111. Mean annual number frequencies of prey items consumed by mountain whitefish in LeClerc Creek for 1988.

	3 +	4 +	All ages
PREY ORGANISMS	n=3	n=1	n=4
Aquatic invertebrates			
Trichoptera (caddisflies)			
Hydropsychidae	0.2		0.1
Rhyacophilidae	0.1	1.5	0.8
Limnephilidae	84.5	6.9	45.7
Brachycentridae	4.4		2.2
Glossosomatidae			
Trichop. pupae			
Other[1]			
Ephemeroptera (mayflies)			
Ephemerellidae	0.8	0.2	0.5
Baetidae	5.1	0.2	2.7
Heptageniidae	0.5	0.8	0.7
Other[2]			
Diptera (flies, midges)			
Chironomidae larvae	4.0		2.0
Chironomidae pupae			
Simuliidae	0.1	90.5	45.3
Tipulidae			
Other[3]			
Plecoptera (stoneflies)			
Perlodidae	0.3		0.2
Nemouridae			
Chloroperlidae			
Other[4]			
Gastropoda[5] (snails)			
Osteichthyes (fish)			
Salmonidae			
Cottidae			
Unidentified			
Coleoptera (beetles)			
Elmidae larvae			
Elmidae adult			
Other[6]			
Hemiptera[7] (true bug)			
Oligochaeta[8] (worms)			
Other[9]			
TOTAL	100.0	100.0	100.0

Table 3.111. (cont.)

	3 +	4 +	All ages
PREY ORGANISMS	n=3	n=1	n=4
Terrestrial invertebrates			
Trichoptera adult			
Diptera (flies, midges)			
Empididae adult			
Chironomidae adults			
Other adults[10]			
Coleoptera (beetles)			
Scarabaeidae			
Staphylinidae			
Carabidae			
Other[11]			
Hemiptera[12] (true bugs)			
Homoptera			
Cicadellidae			
Aphididae			
Cercopidae			
Other[13]			
Hymenoptera (bees, wasps, ants)			
Formicidae			
Other[14]			
Orthoptera[15] (grasshoppers)			
Araneida (spiders, mites)			
Arachnidae			
Lepidoptera	0.1		0.1
Other[16]			
Total	**0.1**		**0.1**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 **Peltoperlidae,** Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae. Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae. Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae. Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

(90.1%) had the highest weight percent for 4+ mountain whitefish, followed by Limnephilidae (9.3%) and Simuliidae (0.3%). For both age classes combined, Limnephilidae, at 52.8 percent, had the highest weight frequency followed by Rhyacophilidae at 45.1 percent and Ephemerellidae at 0.5 percent.

Frequencey of occurrence for prey items consumed by 3+ and 4+ mountain whitefish are presented in Table 3.113. For 3+ mountain whitefish, Limnephiiidae, Baetidae, and Chironomidae larvae each had the highest occurrence frequency at 100 percent. For 4+ mountain whitefish, only a single fish was collected, so all organisms had an occurrence frequency of 100 percent. For both age classes combined, Limnephilidae and Baetidae occurred most frequently at 100 percent, followed by Ephemerellidae at 87.7 percent.

Table 3.114 lists the index of relative importance (IRI) for prey items consumed by 3+ and 4+ mountain whitefish. For 3+ mountain whitefish, Limnephilidae had the highest IRI at 38.4 percent followed by Chironomidae larvae and Baetidae at 14.3 percent each. For 4+ mountain whitefish, Rhyacophilidae (24.0%) had the greatest IRI followed by Simuliidae (23.9%) and Limnephilidae (14.5%). For both age classes combined, Limnephilidae (26.5%) had the highest IRI followed by Baetidae (13.5%), Limnephilidae and Simuliidae (13.3 % each).

3.5.5 BENTHIC MACROINVERTEBRATE ELECTIVITY

3.5.5.1 SKOOKUM CREEK

The measure of prey selection (electivity) for benthic macroinvertebrates was determined for each age class of brown trout, brook trout, and cutthroat trout captured in Skookum Creek.

Brown trout benthic macroinvertebrate electivities are listed in Table 3.115. For 0+ brown trout, the highest electivity was for **Baetidae** (t0.194) and lowest was for Chironomidae larvae (-0.209). For 1+ brown trout, the highest electivity was for Limnephilidae (+0.305) and the lowest was for Chironomidae larvae (-0.241). For 2+ brown trout, the highest electivity was for Glossosomatidae (+0.270) and the lowest was for Chironomidae larvae (-0.251). For 3+ brown trout, the highest electivity was for Perlodidae (+0.166) and the lowest was for Chironomidae larvae (-0.251).

Table 3.112. Mean annual weight frequencies of prey items consumed by mountain whitefish in LeClerc Creek for 1988.

PREY ORGANISMS	3 + n=3	4 + n=1	All ages n=4
Aquatic invertebrates			
Trichoptera (caddisflies)			
Hydropsychidae	1.1		0.6
Rhyacophilidae	0.1	90.1	45.1
Limnephilidae	96.2	9.3	52.8
Brachycentridae	0.5		0.3
Glossosomatidae			
Trichop. pupae			
Other[1]			
Ephemeroptera (mayflies)			
Ephemerellidae	0.8	0.2	0.5
Baetidae	0.7	<0.1	0.4
Heptageniidae	0.1	0.1	0.1
Other[2]			
Diptera (flies, midges)			
Chironomidae larvae	0.1		0.1
Chironomidae pupae			
Simuliidae	<0.1	0.3	0.2
Tipulidae			
Other[3]			
Plecoptera (stoneflies)			
Perlodidae	0.3		0.2
Nemouridae			
Chloroperlidae			
Other[4]			
Gastropoda[5] (snails)			
Osteichthyes (fish)			
Salmonidae			
Cottidae			
Unidentified			
Coleoptera (beetles)			
Elmidae larvae			
Elmidae adult			
Other[6]			
Hemiptera[7] (true bug)			
Oligochaeta[8] (worms)			
Other[9]			
TOTAL	**100.0**	**100.0**	**100.0**

Table 3.112. (cont.)

PREY ORGANISMS	3 + n=3	4 + n=1	All ages n=4
Terrestrial invertebrates			
Trichoptera adult			
Diptera (flies, midges)			
Empididae adult			
Chironomidae adults			
Other adults[10]			
Coleoptera (beetles)			
Scarabaeidae			
Staphylinidae			
Carabidae			
Other[11]			
Hemiptera[12] (true bugs)			
Homoptera			
Cicadellidae			
Aphididae			
Cercopidae			
Other[13]			
Hymenoptera (bees, wasps, ants)			
Formicidae			
Other[14]			
Orthoptera[15] (grasshoppers)			
Araneida (spiders, mites)			
Arachnidae			
Lepidoptera	0.1		0.1
Other [16]			
Total	**0.1**	**0.0**	**0.1**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthamytidae, Mycetophilidae, Tabanidae. Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae. Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.113. Mean annual occurrence frequencies of prey items consumed by mountain whitefish in LeClerc Creek for 1988.

PREYORGANISMS	3 + n=3	4 + n=1	All ages n=4
Aquatic invertebrates			
Trichoptera (caddisflies)			
Hydropsychidae	25.0		12.5
Rhyacophilidae	25.0	100.0	62.5
Limnephilidae	100.0	100.0	100.0
Brachycentridae	25.0		25.0
Gbssosomatidae			
Trichop. pupae			
Other1			
Ephemeroptera (mayflies)			
Ephemerellidae	75.0	100.0	87.7
Baetidae	100.0	100.0	100.0
Heotaaeniidae	25.0	100.0	62.5
Other2			
Diptera (flies, midges)			
Chironomidae larvae	100.0		50.0
Chironomidae pupae			
Simuliidae	25.0	100.0	62.5
Tipulidae			
Other3			
Plecoptera (stoneflies)			
Perlodidae	25.0		12.5
Nemouridae			
Chloroperlidae			
Other4			
Gastropoda5 (snails)			
Osteichthyes (fish)			
Salmonidae			
Cottidae			
Unidentified			
Coleoptera (beetles)			
Elmidae larvae			
Elmidae adult			
Other6			
Hemiptera7 (true bug)			
Oligochaeta8 (worms)			
Other9			

Table 3.113. (cont.)

PREY ORGANISMS	3 + n=3	4 + n=1	All ages n=4
Terrestrial invertebrates			
Trichoptera adult			
Diptera (flies, midges)			
Empididae adult			
Chironomidae adults			
Other adults[10]			
Coleoptera (beetles)			
Scarabaeidae			
Staphylinidae			
Carabidae			
Other[11]			
Hemiptera[12] (true bugs)			
Homoptera			
Cicadellidae			
Aphididae			
Cercopidae			
Other[13]			
Hymenoptera (bees, wasps, ants)			
Formicidae			
Other[14]			
Orthoptera[15] (grasshoppers)			
Araneida (spiders, mites)			
Arachnidae			
Lepidoptera	25.0		12.5
Other[16]			

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae, Dryomyzidae, Dolichopodidae. Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.114. Mean annual index of relative importance frequencies (IRI) of prey items consumed by mountain whitefish in LeClerc Creek for 1988.

PREY ORGANISMS	3 + n=3	4 + n=1	All ages n=4
Aquatic invertebrates			
Trichoptera (caddisflies)			
Hydropsychidae	2.7		1.4
Rhyacophilidae	2.6	24.0	13.3
Limnephilidae	38.4	14.5	26.5
Brachycentridae	5.8		2.9
Glossosomatidae			
Trichop. pupae			
Other[1]			
Ephemeroptera (mayflies)			
Ephemerellidae	11.2	12.6	11.9
Baetidae	14.3	12.6	13.5
Heptageniidae	2.7	12.6	7.7
Other[2]			
Diptera (flies, midges)			
Chironomidae larvae	14.3		7.2
Chironomidae pupae			
Simuliidae	2.6	23.9	13.3
Tipulidae			
Other[3]			
Plecoptera (stoneflies)			
Perlodidae	2.7		1.4
Nemouridae			
Chloroperlidae			
Other[4]			
Gastropoda[5] (snails)			
Osteichthyes (fish)			
Salmonidae			
Cottidae			
Unidentified			
Coleoptera (beetles)			
Elmidae larvae			
Elmidae adult			
Other[6]			
Hemiptera[7] (true bug)			
Oligochaeta[8] (worms)			
Other[9]			
TOTAL	97.3	100.0	98.7

Table 3.114. (cont.)

PREY ORGANISMS	3 + n=3	4 + n=1	All ages n=4
Terrestrial invertebrates			
Trichoptera adult			
Diptera (flies, midges)			
Empididae adult			
Chironomidae adults			
Other adults[10]			
Coleoptera (beetles)			
Scarabaeidae			
Staphylinidae			
Carabidae			
Other[11]			
Hemiptera[12] (true bugs)			
Homoptera			
Cicadellidae			
Aphididae			
Cercopidae			
Other[13]			
Hymenoptera (bees, wasps, ants)			
Formicidae			
Other[14]			
Orthoptera[15] (grasshoppers)			
Araneida (spiders, mites)			
Arachnidae			
Lepidoptera	2.6		1.3
Other [16]			
Total	**2.6**		**1.3**

1 Hydroptilidae, Lepidostomatidae, Leptoceridae, Unidentified.
2 Tricorythidae, Unidentified.
3 Ceratopogonidae, Culicidae, Empididae, Muscidae, Tabanidae, Syrphidae.
4 Peltoperlidae, Unidentified.
5 Lymnaeidae, Planorbidae, Physidae, Unidentified.
6 Dytiscidae, Haliplidae, Amphizoidae, Hydrophilidae.
7 Corixidae, Gerridae.
8 Lumbriculidae, Naididae.
9 Pyralidae, Fish eggs, Hirudinea, Nematoda, Gammaridae, Hydracarina, Astacidae. Sphaeriidae, Cypridae.
10 Anthomyzidae, Mycetophilidae, Tabanidae, Muscidae, Sciaridae, Bibionidae, Pharidae. Dryomyzidae, Dolichopodidae, Dixidae, Stratiomyidae, Unidentified.
11 Cerambycidae, Pselaphidae, Curculionidae, Lathridiidae, Unidentified.
12 Nabidae, Pentatomidae, Unidentified.
13 Adelgidae, Unidentified.
14 Ichneumonidae, Sphecidae, Chalcidae, Bethyloidea, Apidae.
15 Acrididae, Tetrigidae.
16 Sminthuridae, Entomobryidae, Chrysopidae, Machilidae, Forficulidae, Glomerida, Psocidae, Unidentified.

Table 3.115. **The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brown trout in Skookum Creek for 1988.**

Organisms	% Composition in Environment	0+ N=6	1+ N=12	2+ N=3	3+ N=3
TRICHOPTERA					
Hydropsychidae	0.4	-0.004	+0.046	-0.004	-0.004
Rhyacophilidae	5.1	-0.051	-0.051	-0.051	-0.051
Limnephilidae	0.3	+0.024	+0.305	+0.156	+0.120
Brachycentridae	1.8	+0.003	-0.010	+0.018	+0.152
Hydroptilidae	0.8	-0.008	+0.110	-0.008	-0.008
Glossosomatidae	3.4	-0.034	+0.038	+0.270	-0.034
Leptoceridae	0.2	-0.002	-0.002	-0.002	-0.002
EPHEMEROPTERA					
Ephemerellidae	4.1	-0.020	-0.031	-0.041	-0.041
Baetidae	9.8	+0.194	+0.297	-0.062	-0.098
Heptageniidae	8.9	-0.047	-0.084	-0.089	-0.087
Leptophlebiidae	0.7	-0.007	-0.007	-0.007	-0.007
DIPTERA					
Empididae	0.0	0.0	+0.002	0.0	0.0
Chironomidae larvae	25.1	-0.209	-0.241	-0.251	-0.251
Chironomidae pupae	0.9	-0.009	-0.009	+0.009	-0.009
Simuliidae	0.4	-0.004	+0.018	+0.041	-0.004
Tipulidae	1.5	-0.015	-0.015	-0.015	-0.015
Ceratopogonidae	0.3	-0.003	-0.003	-0.003	-0.003
Muscidae	0.0	0.0	0.0	+0.018	0.0
PLECOPTERA					
Chloroperlidae	5.2	-0.052	-0.052	-0.052	-0.052
Perlidae	2.3	-0.023	-0.023	-0.023	-0.023
Perlodidae	0.5	+0.037	+0.006	-0.005	+0.166
Nemouridae	0.5	-0.005	-0.005	-0.005	-0.005
COLEOPTERA					
Elmidae L.	5.6	-0.056	-0.056	-0.056	-0.056
Elmidae adult	0.1	-0.001	+0.001	-0.001	-0.001
HYDRACARINA	1.0	-0.010	-0.010	-0.010	-0.010
COPEPODA					
Harpacticoid	3.9	-0.039	-0.039	-0.039	-0.039
AMPHIPODA	0.1	-0.001	-0.001	-0.001	-0.001
OSTRACODA	0.3	+0.039	-0.003	-0.003	-0.003
OLIGOCHAETA	13.5	-0.093	-0.134	-0.117	-0.135
NEMATODA	1.2	-0.012	-0.012	-0.012	-0.012
TURBELLARIA					
Planariidae	2.1	-0.021	-0.021	-0.021	-0.021
BIVALVIA					
Sphaeriidae	0.2	-0.002	-0.002	-0.002	-0.002

Brook trout benthic macroinvertebrate electivities are listed in Table 3.116. For 0+ brook trout, the highest electivity was for Chironomidae pupae (+0.087) and the lowest was for Oligochaeta (-0.135). For 1 + brook trout, the highest electivity was for Corixidae (+0.174) and the lowest was for Chironomidae larvae (-0.203). For 2+ brook trout, the highest electivity was for Trichoptera pupae (+0.275) and the lowest was for Chironomidae larvae (-0.221).

Cutthroat trout benthic macroinvertebrate electivities are listed in Table 3.117. For 0+ cutthroat trout, the highest electivity was for Oligochaeta (+0.1 IO) and the lowest was for Baetidae (-0.098). For 1+ cutthroat trout, the highest electivity was for Ephemerellidae (+0.146) and the lowest was for Chironomidae larvae (-0.227). For 2+ cutthroat trout, the electivity was highest for both Tipulidae and Dytiscidae at +0.023 and lowest for Chironomidae larvae (-0.251).

3.5.5.2 CEE CEE AH CREEK

The measure of prey selection (electivity) for benthic macroinvertebrates was determined for each age class of brown trout and brook trout captured in Cee Cee Ah Creek.

Brown trout benthic macroinvertebrate electivities are listed in Table 3.118. For 0+ brown trout, the highest electivity was for Simuliidae (+0.069) and the lowest was for Elmidae larvae (-0.084). For 1+ brown trout, the highest electivity was for Halipidae (+0.093) and the lowest was for Elmidae larvae (-0.171). For 2+ brown trout, the highest electivity was for Limnephilidae (+0.186) and the lowest was for Elmidae larvae (-0.186). For 3+ brown trout, the highest electivity was for Limnephilidae (+0.478) and the lowest was for Elmidae larvae (-0.186). For 4+ brown trout, the highest electivity was for Limnephilidae (+0.718) and the lowest was for Elmidae larvae (-0.186). For 5+ brown trout, the highest electivity was for Limnephilidae (+0.997) and the lowest was for Elmidae larvae (-0.186).

Brook trout benthic macroinvertebrate electivities in Cee Cee Ah Creek are listed in Table 3.119. For 0+ brook trout, the highest electivity was for Limnephilidae (+0.134) and lowest was for Elmidae larvae (-0.186). For 1+ brook trout, the highest electivity was for Hydracarina (+0.177) and the lowest was for Elmidae larvae (-0.179). For 2+ brook trout, the highest electivity was for

Table 3.116. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brook trout in Skookum Creek for 1988.

Organisms	% Composition in Environment	0+ N=18	1+ N=15	2+ N=12
TRICHOPTERA				
Hydropsychidae	0.4	-0.004	-0.004	-0.004
Rhyacophilidae	5.1	-0.036	+0.009	-0.039
Limnephilidae	0.3	+0.017	+0.056	+0.089
Brachycentridae	1.8	-0.013	+0.001	-0.015
Hydroptilidae	0.8	-0.008	-0.008	-0.008
Glossosomatidae	3.4	-0.034	-0.034	-0.034
Leptoceridae	0.2	-0.002	-0.002	-0.002
Trichoptera pupae	0.0	0.0	+0.029	+0.275
EPHEMEROPTERA				
Ephemerellidae	4.1	-0.007	+0.013	+0.057
Baetidae	9.8	+0.075	-0.032	-0.073
Heptageniidae	8.9	-0.069	-0.070	-0.086
Leptophlebiidae	0.7	-0.007	-0.007	-0.007
DIPTERA				
Syrphidae	0.0	0.0	0.0	+0.03
Chironomidae larvae	25.1	+0.035	-0.203	-0.221
Chironomidae pupae	0.9	+0.087	-0.01	-0.009
Simuliidae	0.4	-0.004	+0.003	-0.001
Tipulidae	1.5	-0.015	-0.008	-0.015
Ceratopogonidae	0.3	+0.007	+0.004	0.0
Muscidae	0.0	0.0	+0.003	0.0
PLECOPTERA				
Chloroperlidae	5.2	-0.052	-0.052	-0.052
Perlidae	2.3	-0.023	-0.023	-0.023
Perlodidae	0.5	-0.004	-0.005	-0.005
Nemouridae	0.5	-0.005	-0.005	+0.015
COLEOPTERA				
Elmidae larvae	5.6	-0.056	-0.056	-0.056
Elmidae adult	0.1	-0.001	+0.085	-0.001
Dytiscidae	0.0	+0.038	0.0	0.0
HYDRACARINA	1.0	+0.009	-0.010	-0.010
GASTROPODA	0.0	0.0	+0.012	0.0
COPEPODA				
Harpacticoid	3.9	-0.039	-0.039	-0.039
AMPHIPODA	0.1	-0.001	-0.001	-0.001
OSTRACODA	0.3	-0.003	-0.003	-0.003
OLIGOCHAETA	13.5	-0.135	-0.132	-0.135
NEMATODA	1.2	-0.010	-0.012	-0.012
TURBELLARIA				
Planariidae	2.1	-0.021	-0.021	+0.201
BIVALVIA				
Sphaeriidae	0.2	-0.002	-0.002	+0.001
HEMIPTERA				
Corixidae	0.0	0.0	+0.174	+0.020

Table 3.117. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of cutthroat trout in Skookum Creek for 1988.

Organisms	% Composition in Environment	0+ N=3	1+ N=4	2+ N=8
TRICHOPTERA				
Hydropsychidae	0.4	+0.014	-0.004	-0.004
Rhyacophilidae	5.1	-0.051	-0.051	-0.051
Limnephilidae	0.3	+0.102	-0.003	-0.003
Brachycentridae	1.8	+0.001	-0.018	-0.018
Hydroptilidae	0.8	-0.008	-0.008	-0.008
Glossosomatidae	3.4	-0.034	-0.034	-0.034
Leptoceridae	0.2	-0.002	-0.002	-0.002
EPHEMEROPTERA				
Ephemerellidae	4.1	+0.050	+0.146	-0.041
Baetidae	9.8	-0.098	-0.098	-0.098
Heptageniidae	8.9	-0.089	-0.056	-0.089
Leptophlebiidae	0.7	-0.007	-0.007	-0.007
DIPTERA				
Chironomidae larvae	25.1	-0.073	-0.227	-0.251
Chironomidae pupae	0.9	+0.099	-0.009	-0.007
Simuliidae	0.4	+0.014	+0.029	-0.004
Tipulidae	1.5	-0.015	-0.015	+0.023
Ceratopogonidae	0.3	-0.003	-0.003	-0.003
PLECOPTERA				
Chloroperlidae	5.2	-0.052	-0.052	-0.052
Perlidae	2.3	-0.023	-0.023	-0.023
Perlodidae	0.5	-0.005	-0.005	-0.005
Nemouridae	0.5	-0.005	-0.005	-0.005
COLEOPTERA				
Elmidae larvae	5.6	-0.056	-0.056	-0.056
Elmidae adult	0.1	-0.001	-0.001	-0.001
Dytiscidae	0.0	0.0	0.0	+0.023
HYDRACARINA	1.0	-0.010	-0.010	-0.010
COPEPODA				
Harpacticoid	3.9	-0.039	-0.039	-0.039
AMPHIPODA	0.1	-0.001	-0.001	-0.001
OSTRACODA	0.3	-0.003	-0.003	-0.003
OLIGOCHAETA	13.5	+0.110	-0.135	-0.135
NEMATODA	1.2	-0.012	-0.012	-0.012
TURBELLARIA				
Planariidae	2.1	-0.021	-0.021	-0.021
BIVALVIA				
Sphaeriidae	0.2	-0.002	-0.002	-0.002

Table 3.118. The measure of prey selection **(electivity)** for benthic macroinvertebrates (from Hess samples) by each age class of brown trout in Cee Cee Ah Creek for 1988.

Organisms	% Composition in Environment	0+ N=13	1+ N=14	2+ N=12	3+ N=6	4+ N=2	5+ N=1
TRICHOPTERA							
Hydropsychidae	2.1	-0.021	-0.001	+0.018	-0.021	-0.021	-0.021
Rhyacophilidae	1.8	-0.018	+0.033	+0.005	-0.018	+0.053	-0.018
Limnephilidae	0.3	+0.005	+0.049	+0.186	+0.478	+0.718	+0.997
Brachycentridae	5.4	-0.054	+0.065	+0.095	+0.067	-0.054	-0.054
Hydroptilidae	0.3	+0.005	+0.052	0.0	-0.003	-0.003	-0.003
Glossosomatidae	2.4	-0.024	-0.024	-0.024	-0.024	-0.024	-0.024
Trichoptera pupae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Lepidostomatidae	0.0	0.0	+0.005	0.0	0.0	0.0	0.0
EPHEMEROPTERA							
Ephemerellidae	4.8	-0.010	+0.056	+0.004	-0.048	-0.048	-0.048
Baetidae	11.5	+0.014	-0.037	-0.037	-0.115	-0.115	-0.115
Heptageniidae	14.6	-0.073	-0.055	-0.146	-0.146	-0.146	-0.146
Leptophlebiidae	0.6	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
Tricorythidae	0.0	0.0	0.0	+0.013	0.0	0.0	0.0
DIPTERA							
Chironomidae larvae	15.8	+0.060	+0.080	+0.143	+0.120	-0.158	-0.158
Chironomidae pupae	0.3	-0.003	-0.003	+0.034	-0.003	-0.003	-0.003
Simuliidae	2.1	+0.069	+0.090	-0.018	-0.021	-0.021	-0.021
Tipulidae	1.7	-0.017	-0.017	-0.004	-0.017	-0.017	-0.017
Ceratopogonidae	0.2	+0.022	-0.002	-0.002	+0.015	-0.002	-0.002
Tabanidae	0.0	0.0	0.0	+0.040	+0.017	0.0	0.0
PLECOPTERA							
Chloroperlidae	4.0	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Perlidae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Perlodidae	0.2	+0.061	+0.016	-0.002	-0.002	-0.002	-0.002
Nemouridae	1.0	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
Peltoperlidae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
COLEOPTERA							
Elmidae larvae	18.6	-0.084	-0.171	-0.186	-0.186	-0.186	-0.186
Elmidae adult	1.5	+0.006	+0.018	-0.011	+0.061	-0.015	-0.15
Haliplidae	0.0	0.0	+0.093	+0.007	+0.017	0.0	0.0
HYDRACARINA	1.0	-0.010	-0.010	-0.010	-0.010	-0.010	-0.010
COPEPODA							
Harpacticoid	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
OSTRACODA	0.4	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
OLIGOCHAETA	3.0	-0.009	-0.025	+0.035	-0.030	+0.041	-0.030
NEMATODA	0.2	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
TURBELLARIA							
Planariidae	1.3	-0.013	-0.013	-0.013	-0.013	-0.013	-0.013
GASTROPODA	0.4	+0.013	+0.035	+0.025	+0.017	-0.004	-0.004
BIVALVIA							
Sphaeriidae	0.8	0.0	+0.010	-0.008	+0.044	-0.008	-0.008

Limnephilidae (+0.997) and the lowest was for Elmidae larvae (-0.186). For 3+ brook trout, the highest electivity was for Limnephilidae (+0.597) and the lowest was for Elmidae larvae (-0.186).

3.5.5.3 TACOMA CREEK

The measure of prey selection (electivity) for benthic macroinvertebrates was determined for each age class of brook trout and cutthroat trout captured in Tacoma Creek.

Brook trout benthic macroinvertebrate electivities are listed in Table 3.120. For 0+ brook trout, the highest electivity was for Nemouridae (+0.148) and the lowest was for Elmidae larvae (-0.186). For 1+ brook trout, the highest electivity was for Nemouridae (+0.075) and the lowest was for Chironomidae larvae (-0.201). For 2+ brook trout, the highest electivity was for Oligochaeta (+0.046) and the lowest was for Chironomidae larvae (-0.267).

Cutthroat trout benthic macroinvertebrate electivities are listed in Table 3.121. For 0+ cutthroat trout, the highest electivity was for Limnephilidae (+0.165) and the lowest electivity was for Baetidae (-0.097). For 1+ cutthroat trout, the highest electivty was for Brachycentridae (+0.171) and the lowest was for Chironomidae larvae (-0.225). For 2+ cutthroat trout, Baetidae (+0.074) had the only positive electivity and Chironomidae larvae (-0.218) had the lowest electivity.

3.5.5.4 LECLERC CREEK

The measure of prey selection (electivity) for benthic macroinvertebrates was determined for each age class of brown trout, brook trout, cutthroat trout, and mountain whitefish captured in LeClerc Creek.

Brown trout benthic macroinvertebrate electivities are listed in Table 3.122. For 0+ brown trout, the highest electivity was for Chironomidae larvae (+0.182) and the lowest electivity was for Oligochaeta (-0.154). For 1+ brown trout, the highest electivity was for Limnephilidae (+0.236) and the lowest was for Oligochaeta (-0.154). For 2+ brown trout, the highest electivity was for Ephemerellidae (+0.152) and the lowest was for Chironomidae larvae (-0.159). For 3+ brown trout, the highest electivity was for Limnephilidae (+0.240) and the lowest was for Chironomidae larvae

Table 3.119. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brook trout in Cee Cee Ah Creek for 1988.

Organisms	% Composition in Environment	0+ N=9	1+ N=16	2+ N=l	3+ N=l
TRICHOPTERA					
Hydropsychidae	2.1	+0.005	-0.021	-0.021	-0.021
Rhyacophilidae	1.a	+0.107	+0.078	-0.01 a	-0.01 a
Limnephilidae	0.3	+0.134	+0.128	+0.997	+0.597
Brachycentridae	5.4	-0.032	-0.021	-01.054	-0.145
Hydroptilidae	0.3	-0.003	-0.003	-0.003	-0.003
Glossosomatidae	2.4	-0.024	-0.024	-0.024	-0.024
Trichoptera pupae	0.2	-0.002	-0.002	-0.002	-0.002
EPHEMEROPTERA					
Ephemerellidae	4.8	-0.026	-0.048	-0.048	-0.048
Baetidae	11.5	-0.122	-0.075	-0.115	-0.115
Heptageniidae	14.6	-0.146	-0.141	-0.146	-0.146
Leptophhlebiidae	0.6	-0.006	-0.006	-0.006	-0.006
DIPTERA					
Chironomidae larvae	15.8	-0.032	-0.078	-0.158	-0.158
Chironomidae pupae	0.3	-0.003	-0.003	-0.003	-0.003
Simuliidae	2.1	-0.021	+0.013	-0.021	-0.021
Tipulidae	1.7	-0.017	+0.010	-0.017	-0.017
Ceratopogonidae	0.2	-0.002	-0.002	-0.002	-0.002
PLECOPTERA					
Chloroperlidae	4.0	-0.040	+0.043	-0.040	-0.040
Perlidae	0.3	-0.003	-0.003	-0.003	-0.003
Perlodidae	0.2	+0.038	+0.026	-0.002	-0.002
Nemouridae	1.0	-0.010	+0.018	-0.010	-0.010
Peltoperlidae	0.3	+0.010	+0.009	-0.003	-0.003
COLEOPTERA					
Elmidae larvae	18.6	-0.186	-0.179	-0.186	-0.186
Elmidae adult	1.5	-0.015	-0.008	-0.015	-0.015
HYDRACARINA	1.6	+0.119	+0.177	-0.016	-0.016
COPEPODA					
Harpacticoid	0.1	-0.001	-0.001	-0.001	-0.001
OSTRACODA	0.4	-0.004	-0.004	-0004	-0.004
OLIGOCHAETA	3.0	-0.017	-0.025	-0.030	-0.030
NEMATODA	0.2	-0.002	-0.002	-0.002	-0.002
TURBELLARIA					
Planariidae	1.3	-0.013	-0.013	-0.013	-0.013
GASTROPODA	0.4	-0.004	-0.004	-0.004	-0.004
BIVALVIA					
Sphaeriidae	0.8	-0.008	+0.006	-0.008	-0.008
LEPIDOPTERA					
Pyralidae	0.0	0.0	+0.007	0.0	0.0

Table 3.120. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brook trout in Tacoma Creek for 1988.

Organisms	% Composition in Environment	0+ N=20	1+ N=25	2+ N=6
TRICHOPTERA				
Hydropsychidae	4.0	-0.008	-0.017	-0.040
Rhyacophilidae	1.4	-0.014	-0.004	-0.028
Limnephilidae	0.2	+0.009	+0.026	+0.030
Brachycentridae	5.4	+0.103	+0.057	+0.029
Hydroptilidae	0.2	-0.002	-0.016	-0.002
Glossosomatidae	1.1	-0.011	-0.011	-0.011
Trichoptera pupae	0.2	-0.002	-0.002	-0.002
EPHEMEROPTERA				
Ephemerellidae	8.2	-0.025	-0.032	-0.040
Baetidae	9.7	-0.052	-0.036	+0.028
Heptageniidae	2.4	-0.021	-0.004	-0.024
Leptophlebiidae	3.7	-0.037	-0.037	-0.037
DIPTERA				
Chironomidae larvae	26.7	-0.066	-0.201	-0.267
Chironomidae pupae	0.6	+0.060	-0.006	-0.006
Simuliidae	3.4	+0.025	+0.062	-0.034
Tipulidae	1.5	-0.012	-0.015	-0.015
Ceratopogonidae	0.6	-0.002	-0.003	-0.006
Empididae	0.2	+0.005	0.0	0.0
Psychodidae	4.0	-0.040	-0.040	-0.040
Tabanidae	0.0	0.0	+0.001	0.0
PLECOPTERA				
Chloroperlidae	1.8	-0.018	-0.018	-0.018
Perlodidae	0.1	-0.001	+0.009	-0.001
Nemouridae	0.4	+0.148	+0.075	-0.004
COLEOPTERA				
Elmidae larvae	18.6	-0.186	-0.186	-0.186
Elmidae adult	1.5	+0.004	+0.045	+0.010
HYDRACARINA	0.7	+0.004	-0.002	-0.007
HOMOPTERA				
Corixidae	0.0	0.0	+0.004	0.0
AMPHIPODA	0.1	-0.001	-0.001	-0.001
OSTRACODA	0.1	-0.001	-0.001	-0.001
OLIGOCHAETA	1.3	+0.013	-0.001	+0.046
TURBELLARIA				
Planariidae	0.4	-0.004	-0.004	-0.004
GASTROPODA	0.2	-0.002	-0.002	-0.002
BIVALVIA				
Sphaeriidae	0.6	-0.002	-0.003	-0.006

Table 3.121. The measure of prey selection (electivity) for bent hic macroinvertebrates (from Hess samples) by each age class of cutthroat trout in Tacoma Creek for 1988.

Organisms	% Composition in Environment	0+ N=2	1+ N=5	2+ N=4
TRICHOPTERA				
Hydropsychidae	4.0	+0.127	-0.003	-0.040
Rhyacophilidae	1.4	-0.014	-0.014	-0.014
Limnephilidae	0.2	+0.165	-0.002	-0.002
Brachycentridae	5.4	-0.054	+0.171	-0.031
Hydroptilidae	0.2	+0.002	+0.046	-0.002
Glossosomatidae	1.1	-0.011	-0.011	-0.011
Trichoptera pupae	0.2	-0.002	-0.002	-0.002
EPHEMEROPTERA				
Ephemerellidae	8.2	-0.082	-0.016	-0.082
Baetidae	9.7	-0.097	-0.070	+0.074
Heptageniidae	2.4	-0.024	+0.008	-0.024
Leptophlebiidae	3.7	-0.037	-0.037	-0.037
DIPTERA				
Chironomidae larvae	26.7	+0.066	-0.225	-0.218
Chironomidae pupae	0.6	-0.006	+0.026	-0.006
Simuliidae	3.4	-0.034	-0.024	-0.034
Tipulidae	1.5	-0.015	+0.001	-0.015
Ceratopogonidae	0.6	-0.006	-0.006	-0.006
Empididae	0.2	-0.002	-0.002	-0.002
Psychodidae	4.0	-0.040	-0.040	-0.040
PLECOPTERA				
Chloroperlidae	1.8	-0.018	-0.018	-0.018
Perlodidae	0.1	-0.001	+0.096	-0.001
Nemouridae	0.4	-0.004	-0.004	-0.004
COLEOPTERA				
Elmidae larvae	18.6	+0.147	-0.112	-0.137
Elmidae adult	1.5	-0.015	+0.140	-0.015
HYDRACARINA	0.7	-0.007	-0.007	-0.007
AMPHIPODA	0.1	-0.001	-0.001	-0.001
OSTRACODA	0.1	-0.001	-0.001	-0.001
OLIGOCHAETA	1.3	-0.013	-0.013	-0.013
TURBELLARIA				
Planariidae	0.4	-0.004	-0.004	-0.004
GASTROPODA	0.2	-0.002	-0.002	-0.002
BIVALVIA				
Sphaeriidae	0.6	-0.006	-0.006	-0.006

(-0.159). For 4+ brown trout, the highest electivity was for Limnephilidae (+0.160) and the lowest was for Chironomidae larvae (-0.159).

Brook trout benthic macroinvertebrate electivities are listed in Table 3.123. For 0+ brook trout, the highest electivity was for Chironomidae larvae (+0.363) and the lowest was for Oligochaeta (-0.154). For 1+ brook trout, the highest electivity was for Limnephilidae (+0.195) and the lowest was for Oligochaeta (-0.151). For 2+ brook trout, the highest electivity was for Limnephilidae (+0.520) and the lowest was for Oligochaeta (-0.147).

Benthic macroinvertebrate electivities for 2+ cutthroat trout are listed in Table 3.124. The highest electivity was for Pyralidae (+0.024) and the lowest was for Chironomidae larvae (-0.159).

Mountain whitefish macroinvertebrate electivities are listed in Table 3.125. For 3+ mountain whitefish, the highest electivity was for Limnephilidae (+0.844) and the lowest was for Oligochaeta (-0.154). For 4+ mountain whitefish, the highest was for Simuliidae (+0.879) and the lowest was for Chironomidae larvae (-0.159).

3.5.6 DRIFTING INVERTEBRATE ELECTIVITY

3.5.6.1 SKOOKUM CREEK

The measure of prey selection (electivity) for both aquatic and terrestrial drifting invertebrates was determined for each age class of brown trout, brook trout, and cutthroat trout captured in Skookum Creek.

Brown trout electivities for drifting invertebrates are listed in Table 3.126. Electivity for aquatic invertebrates by 0+ brown trout was highest for Baetidae (+0.190) and lowest for Chironomidae larvae (-0.588). For terrestrial invertebrates, the highest electivity was for Trichoptera adult (+0.374) and the lowest was for Chironomidae adult (-0.071). For 1+ brown trout, the highest aquatic invertebrate electivity was for Baetidae (+0.294) and lowest was for Chironomidae larvae (-0.620). The highest selection for terrestrial invertebrates was for Apidae (+0.220) and lowest was for Chironomidae adult (-0.071). Aquatic invertebrate electivity by 2+ brown trout was highest for Limnephilidae (+0.308) and lowest for Chironomidae larvae (-0.630). For terrestrial invertebrates, the highest selection was for Formicidae (+0.123) and the lowest was

Table 3.122. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brown trout in LeClerc Creek for 1988.

Organisms	% Composition in Environment	0+ N=6	1+ N=7	2+ N=10	3+ N=6	4+ N=3
TRICHOPTERA						
Hydropsychidae	2.2	-0.022	-0.022	-0.016	-0.022	-0.022
Rhyacophilidae	3.7	-0.037	+0.100	-0.011	-0.037	+0.035
Limnephilidae	0.2	-0.002	+0.236	+0.128	+0.240	+0.160
Brachycentridae	5.7	-0.057	+0.060	+0.149	-0.001	+0.136
Glossosomatidae	2.1	-0.021	-0.021	-0.021	-0.021	-0.021
Leptoceridae	0.0	0.0	0.0	0.0	0.0	+0.012
Trichoptera pupae	0.7	-0.007	-0.007	-0.007	-0.007	-0.007
EPHEMEROPTERA						
Ephemerellidae	8.4	+0.027	-0.002	+0.152	-0.067	-0.072
Baetidae	15.3	-0.047	-0.119	-0.041	-0.136	-0.129
Heptageniidae	8.2	-0.055	-0.070	-0.070	-0.082	-0.082
DIPTERA						
Chironomidae larv.	15.9	+0.182	-0.029	-0.159	-0.159	-0.159
Chironomidae pupae	0.4	-0.004	-0.004	-0.004	-0.004	-0.004
Simuliidae	2.6	+0.027	-0.026	-0.057	-0.026	-0.026
Tipulidae	1.4	-0.014	-0.014	-0.014	-0.014	-0.002
Ceratopogonidae	0.4	-0.004	-0.004	-0.004	-0.004	-0.004
Empididae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003
Tabanidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001
Muscidae	0.0	0.0	0.0	0.0	+0.111	0.0
Plecoptera						
Chloroperlidae	4.4	-0.044	-0.044	-0.044	-0.044	-0.044
Perlidae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
Perlodidae	0.1	-0.001	+0.018	+0.005	-0.001	-0.001
Nemouridae	0.6	-0.006	-0.006	-0.006	-0.006	-0.006
Coleoptera						
Elmidae larvae	8.8	-0.088	-0.088	-0.079	-0.071	-0.088
Elmidae adult	0.3	-0.003	-0.003	+0.053	+0.053	-0.003
HYDRACARINA	0.4	+0.121	-0.004	-0.004	-0.004	-0.004
OLIGOCHAETA	15.4	-0.154	-0.154	-0.088	-0.154	-0.154
NEMATODA	0.5	-0.005	-0.005	-0.005	-0.005	+0.007
TURBELLARIA						
Planariidae	1.1	-0.011	-0.011	-0.011	-0.011	-0.011
COLLEMBOLA						
Entomobryidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001
GASTROPODA	0.03	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003

Table 3.123. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of brook trout in LeClerc Creek for 1988.

Organisms	% Composition in Environment	0+ N=12	1+ N=18	2+ N=5
TRICHOPTERA				
Hydropsychidae	2.2	-0.020	-0.022	-0.022
Rhyacophilidae	3.7	-0.037	-0.015	-0.037
Limnephilidae	0.2	+0.037	+0.195	+0.520
Brachycentridae	5.7	+0.018	+0.128	-0.012
Glossosomatidae	2.1	-0.021	-0.021	-0.009
Trichoptera pupae	0.7	-0.007	-0.007	-0.007
EPHEMEROPTERA				
Ephemerellidae	8.4	-0.078	-0.070	-0.084
Baetidae	15.3	-0.122	-0.065	-0.141
Heptageniidae	8.2	-0.082	-0.076	-0.082
DIPTERA				
Chironomidae larvae	15.9	+0.363	-0.017	-0.108
Chironomidae pupae	0.4	-0.004	-0.004	-0.004
Simuliidae	2.6	+0.057	-0.020	-0.026
Tipulidae	1.4	-0.014	-0.014	-0.014
Ceratopogonidae	0.4	-0.004	-0.004	-0.004
Empididae	0.3	-0.003	-0.003	-0.003
Tabanidae	0.1	-0.001	-0.001	-0.001
PLECOPTERA				
Chloroperlidae	4.4	-0.044	-0.044	-0.044
Perlidae	0.2	-0.002	-0.002	-0.002
Perlodidae	0.1	-0.001	-0.001	+0.011
Nemouridae	0.6	-0.006	-0.006	-0.006
COLEOPTERA				
Elmidae larvae	8.8	-0.086	-0.083	-0.081
Elmidae adult	0.3	+0.017	+0.014	+0.004
HYDRACARINA	0.4	+0.020	-0.004	+0.010
OLIGOCHAETA	15.4	-0.154	-0.151	-0.147
NEMATODA	0.5	-0.005	-0.005	-0.005
TURBELLARIA				
Planariidae	1.1	-0.011	-0.011	-0.011
COLLEMBOLA				
Entomobryidae	0.1	+0.001	-0.001	-0.001
GASTROPODA	0.03	-0.0003	+0.003	-0.0003

Table 3.124. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of cutthroat trout in LeClerc Creek for 1988.

Organisms	% Composition in Environment	2+ N = l
TRICHOPTERA		
Hydropsychidae	2.2	-0.022
Rhyacophilidae	3.7	-0.037
Limnephilidae	0.2	-0.002
Brachycentridae	5.7	-0.057
Glossosomatidae	2.1	-0.021
Trichoptera pupae	0.7	-0.007
EPHEMEROPTERA		
Ephemerellidae	8.4	-0.011
Baetidae	15.3	-0.153
Heptageniidae	8.2	-0.082
DIPTERA		
Chironomidae larvae	15.9	-0.159
Chironomidae pupae	0.4	-0.004
Simuliidae	2.6	-0.026
Tipulidae	1.4	-0.014
Ceratopogonidae	0.4	-0.004
Empididae	0.3	-0.003
Tabanidae	0.1	-0.001
PLECOPTERA		
Chloroperlidae	4.4	-0.044
Perlidae	0.2	-0.002
Perlodidae	0.1	-0.00 1
Nemouridae	0.6	-0.006
COLEOPTERA		
Elmidae larvae	8.8	-0.088
Elmidae adult	0.3	to.021
HYDRACARINA	0.4	-o.004
OLIGOCHAETA	15.4	-o.154
NEMATODA	0.5	-o.005
TURBELLARIA		
Planariidae	1.1	-0.011
COLLEMBOLA		
Entomobryidae	0.1	-0.001
GASTROPODA	0.03	-0.0003
LEPIDOPTERA		
Pyralidae	0.0	+0.024

Table 3.125. The measure of prey selection (electivity) for benthic macroinvertebrates (from Hess samples) by each age class of mountain whitefish in LeClerc Creek for 1988.

Organisms	% Composition in Environment	3+ N=3	4+ N=1
TRICHOPTERA			
Hydropsychidae	2.2	-0.020	-0.020
Rhyacophilidae	3.7	-0.036	-0.022
Limnephilidae	0.2	+0.844	+0.067
Brachycentridae	5.7	+0.013	-0.057
Glossosomatidae	2.1	-0.021	-0.021
Trichoptera pupae	0.7	-0.007	-0.007
EPHEMEROPTERA			
Ephemerellidae	8.4	+0.076	+0.082
Baetidae	15.3	-0.102	-0.151
Heptageniidae	8.2	-0.077	-0.074
DIPTERA			
Chironomidae lar.	15.9	-0.119	-0.159
Chironomidae pupae	0.4	-0.004	-0.004
Simuliidae	2.6	-0.025	+0.879
Tipulidae	1.4	-0.014	-0.014
Ceratopogonidae	0.4	-0.004	-0.004
Empididae	0.3	-0.003	-0.003
Tabanidae	0.1	-0.001	-0.001
PLECOPTERA			
Chloroperlidae	4.4	-0.044	-0.044
Perlidae	0.2	-0.002	-0.002
Perlodidae	0.1	+0.002	-0.001
Nemouridae	0.6	-0.006	-0.006
COLEOPTERA			
Elmidae larvae	8.8	-0.088	-0.088
Elmidae adults	0.3	-0.003	-0.003
HYDRACARINA	0.4	-0.004	-0.004
OLIGOCHAETA	15.4	-0.154	-0.154
NEMATODA	0.5	-0.005	-0.005
TURBELLARIA			
Planariidae	1.1	-0.011	-0.011
COLLEMBOLA			
Entomobryidae	0.1	-0.001	-0.001
GASTROPODA	0.03	~-0.0003	~-0.0003

for Chironomidae adult (-0.071). For 3+ brown trout, aquatic invertebrate electivity was highest for Perlodidae (+0.171) and lowest for Chironomidae larvae (-0.630). The highest selection for terrestrial invertebrates was for Araneida (+0.167) and the lowest was for Chironomidae adult (-0.071).

Brook trout electivities for drifting invertebrates are listed in Table 3.127. Electivity for aquatic invertebrates by 0+ brook trout was highest for Baetidae (+0.071) and lowest for Chironomidae larvae (-0.344). For terrestrial invertebrates, Empididae (+0.106) had the highest electivity and Ceratopogonidae (-0.008) had the lowest. For 1+ brook trout, the highest aquatic selection was for Corixidae (+0.174) and the lowest was for Chironomidae larvae (-0.582). For terrestrial invertebrates, the highest electivity was for Stratiomyidae (+0.167) and the lowest was for Ceratopogonidae (-0.008). For 2+ brook trout, the highest aquatic invertebrate selection was for Trichoptera pupae (+0.275) and lowest was for Chironomidae larvae (-0.600). For terrestrial invertebrates, the highest electivity was for Formicidae (+0.032) and the lowest was for Ceratopogonidae (-0.008).

Cutthroat trout electivities for drifting invertebrates are listed in Table 3.128. Electivity for aquatic invertebrates by 0+ cuttthroat trout was highest for Limnephilidae (+0.105) and lowest for Chironomidae larvae (-0.445). For terrestrial invertebrates, the highest selection was for Empididae (+0.327) and the lowest was for Aphididae (-0.025). For 1+ cutthroat trout, the highest aquatic electivity was for Ephemerellidae (+0.158) and lowest was for Chironomidae larvae (-0.597). The highest terrestrial invertebrate electivity was for Empididae (+0.283) and the lowest was for Aphididae (-0.025). For 2+ cutthroat trout, electivity for aquatic invertebrates was highest for Dytiscidae (+0.037) and lowest for Chironomidae larvae (-0.630). For terrestrial invertebrates, the highest electivity was for Empididae (+0.370) and the lowest was for Aphididae (-0.025).

3.5.6.2 CEE CEE AH CREEK

The measure of prey selection (electivity) for both aquatic and terrestrial drifting invertebrates was determined for each age class of brown trout and brook trout captured in Cee Cee Ah Creek.

Brown trout electivities for drifting invertebrates are listed in Table 3.129. Electivity for aquatic invertebrates by 0+ brown trout was highest for Baetidae (+0.174) and lowest for

Table 3.126. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of brown trout in Skookum Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=6	1+ N=12	2+ N=3	3 N=3
TRICHOPTERA					
Hydropsychidae	0.2	-0.002	+0.048	-0.002	-0.002
Rhyacophilidae	1.3	-0.013	-0.013	-0.013	-0.013
Limnephilidae	0.0	0.0	+0.027	+0.308	+0.159
Brachycentridae	1.0	+0.011	-0.002	+0.026	+0.160
Hydroptilidae	0.1	-0.001	+0.117	+0.001	+0.001
Leptoceridae	0.1	-0.001	-0.001	-0.001	+0.001
Glossosomatidae	0.0	0.0	+0.072	+0.304	0.0
EPHEMEROPTERA					
Ephemerellidae	0.9	+0.012	+0.001	-0.009	-0.009
Baetidae	10.2	+0.190	+0.294	-0.066	-0.102
Heptageniidae	1.0	+0.032	-0.005	-0.010	-0.010
DIPTERA					
Chironomidae larvae	63.0	-0.588	-0.620	-0.630	-0.630
Chironomidae pupae	5.7	-0.057	-0.057	-0.039	-0.057
Simuliidae	0.9	-0.009	+0.013	+0.036	-0.009
Tipulidae	0.2	-0.002	-0.002	-0.002	-0.002
Tabanidae	0.3	-0.003	-0.003	-0.003	-0.003
Empididae	0.1	-0.001	+0.001	-0.001	-0.001
Psychodidae	0.4	-0.004	-0.004	-0.004	-0.004
Muscidae	0.0	0.0	0.0	+0.018	0.0
Blephariceridae	0.1	-0.001	-0.001	-0.001	-0.001
PLECOPTERA					
Perlodidae	0.0	+0.042	+0.011	0.0	+0.171
Nemouridae	1.1	-0.011	-0.011	-0.011	-0.011
Pteronarcyidae	0.1	-0.001	-0.001	-0.001	-0.001
Chloroperlidae	0.3	-0.003	-0.003	-0.003	-0.003
COLEOPTERA					
Elmidae larvae	4.5	-0.045	-0.045	-0.045	-0.045
Elmidae adult	0.2	-0.002	0.0	-0.002	-0.002
Lampyridae	0.04	-0.0004	-0.0004	-0.0004	-0.0004
HYDRACARINA	0.9	-0.009	-0.009	-0.009	-0.009
OSTRACODA	0.1	+0.041	-0.001	-0.001	-0.001
OLIGOCHAETA	0.4	+0.038	-0.003	+0.014	-0.004
NEMATODA	0.1	-0.001	-0.001	-0.001	-0.001
GASTROPODA	0.2	-0.002	-0.002	-0.002	-0.002
BIVALVIA	2.3	-0.023	-0.023	-0.023	-0.023

Table 3.126. (cont.)

Terrestrial Organisms	% Composition in Environment	0+ N=6	1+ N=12	2+ N=3	3+ N=3
TRICHOPTERA adult	0.0	+0.374	+0.017	0.0	0.0
EPHEMEROPTERA adult	0.1	-0.001	-0.001	-0.001	-0.001
DIPTERA					
Chironomidae	7.1	-0.071	-0.071	-0.071	-0.071
Sciaridae	0.2	-0.002	-0.002	-0.002	-0.002
Empididae	0.0	0.0	0.0	+0.091	0.0
Ceratopogonidae	0.8	-0.008	-0.008	-0.008	-0.008
COLEOPTERA					
Buprestidae	0.1	-0.001	-0.001	-0.001	-0.001
HOMOPTERA					
Apidae	2.5	-0.025	+0.220	-0.025	-0.025
Coccoiiea	0.1	-0.001	-0.001	-0.001	-0.001
PSOCOPTERA					
Psocidae	0.1	-0.001	-0.001	-0.001	-0.001
Polypsocidae	0.1	-0.001	-0.o.001	-o.001	-0.001
HYMENOPTERA					
Formicidae	0.1	-0.001	+0.001	+0.123	-0.001
Eurytomidae	0.1	-0.001	-0.001	-0.001	-0.001
Chalcidae	0.1	-0.001	-0.001	-0.001	-0.001
ARANEIDA	0.0	0.0	0.0	0.0	+0.167
LEPIDOPTERA					
COLLEMBOLA	0.0	+0.083	0.0	0.0	0.0
DERMAPTERA	0.0	0.0	0.0	0.0	+0.330

Table 3.127. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of brook trout in Skookum Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=18	1+ N=15	2+ N=12
TRICHOPTERA				
Hydropsychidae	0.2	-0.002	-0.002	-0.002
Rhyacophilidae	1.3	+0.002	+0.057	-0.001
Limnephilidae	0.0	+0.020	+0.059	+0.092
Brachycentridae	1.0	-0.005	+0.009	-0.007
Hydroptilidae	0.1	+0.001	+0.001	+0.001
Leptoceridae	0.1	+0.001	+0.001	+0.001
Trichoptera pupae	0.0	0.0	+0.029	+0.275
EPHEMEROPTERA				
Ephemerellidae	0.9	+0.025	+0.045	+0.089
Baetidae	10.2	+0.071	-0.066	+0.077
Heptageniidae	1.0	+0.010	+0.009	-0.007
DIPTERA				
Chironomidae larvae	63.0	-0.344	-0.582	-0.600
Chironomidae pupae	5.7	+0.039	-0.049	-0.057
Ceratopogonidae	0.0	+0.010	-0.007	-0.003
Simuliidae	0.9	-0.009	-0.002	-0.006
Tipulidae	0.2	-0.002	+0.005	-0.002
Tabanidae	0.3	-0.003	-0.003	-0.003
Empididae	0.1	-0.001	-0.001	-0.001
Psychodidae	0.4	-0.004	-0.004	-0.004
Muscidae	0.0	0.0	+0.003	0.0
Blephariceridae	0.1	-0.001	-0.001	-0.001
Syrphidae	0.0	0.0	0.0	+0.003
PLECOPTERA				
Perlodidae	0.0	+0.001	0.0	0.0
Nemouridae	1.1	-0.011	-0.011	+0.009
Pteronarcyidae	0.1	-0.001	-0.001	-0.001
Chloroperlidae	0.3	-0.003	-0.003	-0.003
COLEOPTERA				
Elmidae larvae	4.5	-0.045	-0.045	-0.045
Elmidae adult	0.2	-0.002	+0.081	-0.002
Dytiscidae	0.0	+0.038	0.0	0.0
Lampyridae	0.04	-0.0004	-0.0004	-0.0004
HEMIPTERA				
Corixidae	0.0	0.0	+0.174	+0.020
HYDRACARINA	0.9	+0.010	-0.009	-0.009
OSTRACODA	0.1	-0.001	-0.001	-0.001
OLIGOCHAETA	0.4	-0.004	-0.001	-0.004
NEMATODA	0.1	+0.001	-0.001	-0.001
GASTROPODA	0.2	-0.002	+0.010	-0.002
BIVALVIA	2.3	-0.023	-0.023	-0.020

Table 3.127. (cont.)

Terrestrials Oraanisms	% Composition in Environment	0+ N=18	1+ N=15	2+ N=12
TRICHOPTERA adult	0.0	+0.007	0.0	+0.005
EPHEMEROPTERA adult	0.1	-0.001	-0.001	-0.001
DIPTERA				
Chironomidae	0.0	0.0	+0.042	0.0
Sciaridae	0.2	+0.013	-0.002	-0.002
Bibionidae	0.0	+0.012	0.0	0.0
Stratiomyidae	0.0	0.0	+0.167	0.0
Empididae	0.0	+0.106	+0.042	0.0
Ceratopogonidae	0.8	-0.008	-0.008	-0.008
COLEOPTERA				
Buprestidae	0.1	-0.001	-0.001	-0.001
Carabidae	0.0	0.0	0.0	+0.005
Scarabaeidae	0.0	0.0	0.0	+0.003
Pselaphidae	0.0	+0.001	0.0	0.0
Curculionidae	0.0	0.0	+0.003	+0.003
Lathridiidae	0.0	0.0	+0.008	0.0
Staphylinidae	0.0	+0.001	0.0	0.0
HOMOPTERA				
Apidae	2.5	+0.006	+0.045	0.0
Coccoidea	0.1	-0.001	-0.001	-0.001
Cicadellidae	0.0	+0.005	0.0	0.0
PSOCOPTERA				
Psocidae	0.1	+0.019	-0.001	-0.001
Polypsocidae	0.1	-0.001	-0.001	-0.001
HYMENOPTERA				
Formicidae	0.1	+0.010	+0.056	+0.032
Eurytomidae	0.1	-0.001	-0.001	-0.001
Chalcidae	0.1	-0.001	+0.003	-0.001
Ichneumonidae	0.0	+0.001	+0.004	0.0
ARANEIDA	0.0	+0.016	+0.003	+0.011
LEPIDOPTERA	0.0	0.0	+0.003	+0.003
COLLEMBOLA	0.0	+0.004	0.0	0.0

Table 3.128. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of cutthroat trout in Skookum Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=3	1+ N=4	2+ N=8
TRICHOPTERA				
Hydropsychidae	0.2	+0.016	-0.002	-0.002
Rhyacophilidae	1.3	-0.013	-0.013	-0.013
Limnephilidae	0.0	+0.105	0.0	0.0
Brachycentridae	1.0	+0.009	-0.010	-0.010
Hydroptilidae	0.1	-0.001	-0.001	-0.001
Leptoceridae	0.1	-0.001	-0.001	-0.001
EPHEMEROPTERA				
Ephemerellidae	0.9	+0.082	+0.158	-0.009
Baetidae	10.2	-0.102	-0.102	-0.102
Heptageniidae	1.0	-0.010	+0.023	-0.010
DIPTERA				
Chironomidae larvae	63.0	-0.445	-0.597	-0.630
Chironomidae pupae	5.7	+0.051	-0.057	-0.057
Ceratopogonidae	0.3	-0.003	-0.003	-0.003
Simuliidae	0.9	+0.009	+0.016	-0.009
Tipulidae	0.2	-0.002	+0.006	+0.035
Tabanidae	0.3	-0.003	-0.003	-0.003
Empididae	0.1	-0.001	-0.001	-0.001
Psychodidae	0.4	-0.004	-0.004	-0.004
Blephariceridae	0.1	-0.001	-0.001	-0.001
PLECOPTERA				
Perlodidae	0.5	-0.005	-0.005	-0.005
Nemouridae	1.1	-0.011	-0.011	-0.011
Pteronarcyidae	0.1	-0.001	-0.001	-0.001
Chloroperlidae	0.3	-0.003	-0.003	-0.003
COLEOPTERA				
Elmidae larvae	4.5	-0.045	-0.045	-0.045
Elmidae adult	0.2	-0.002	-0.002	-0.002
Dytiscidae	0.0	0.0	0.0	+0.037
Lampyridae	0.04	-0.0004	-0.0004	-0.0004
HYDRACARINA	0.9	-0.009	-0.009	-0.009
OSTRACODA	0.1	-0.001	-0.001	-0.001
OLIGOCHAETA	0.4	+0.021	-0.004	-0.004
NEMATODA	0.1	-0.001	-0.001	-0.001
GASTROPODA	0.2	-0.002	-0.002	-0.002
BIVALVIA	2.3	+0.023	-0.023	-0.023

Table 3.128. (cont.)

Terrestrials Organisms	% Composition in Environment	0+ N=3	1+ N=4	2+ N=8
TRICHOPTERA adult	0.0	+0.050	+0.040	0.0
EPHEMEROPTERA adult	0.1	-0.001	-0.001	-0.001
DIPTERA				
Chironomidae	0.0	0.0	+0.002	0.0
Sciaridae	0.2	-0.002	+0.043	+0.035
Bibionidae	0.0	0.0	+0.013	+0.078
Mycetophilidae	0.0	0.0	+0.005	0.0
Empididae	0.0	+0.327	+0.283	+0.370
Pharidae	0.0	0.0	+0.004	0.0
Dryomyzidae	0.0	0.0	0.0	+0.037
Ceratopogonidae	0.8	-0.008	-0.008	-0.008
PLECOPTERA adult	0.0	0.0	0.0	+0.037
COLEOPTERA				
Buprestidae	0.1	-0.001	-0.001	-0.001
Carabidae	0.0	+0.018	0.0	0.0
Staphylinidae	0.0	0.0	+0.015	0.0
Limnichidae	0.0	0.0	0.0	+0.037
HEMIPTERA				
Pentatomidae	0.0	0.0	+0.004	0.0
HOMOPTERA				
Aphididae	2.5	-0.025	-0.025	-0.025
Coccoidea	0.1	+0.001	-0.001	-0.001
Cicadellidae	0.0	+0.019	+0.015	+0.037
PSOCOPTERA				
Psocidae	0.1	-0.001	-0.001	-0.001
Polvpsocidae	0.1	-0.001	-0.001	-0.001
HYMENOPTERA				
Formicidae	0.1	-0.001	-0.084	-0.110
Sphecidae	0.0	0.0	0.0	+0.037
Eurytomidae	0.1	-0.001	-0.001	-0.001
Chalcidae	0.1	-0.001	-0.001	-0.001
Ichneumonidae	0.0	0.0	+0.022	+0.074
Bethylidae	0.0	0.0	+0.005	0.0
ARANEIDA	0.0	0.0	+0.111	+0.037
LEPIDOPTERA	0.0	0.0	+0.033	+0.037
c o -	r n	0.0	+0.004	0.0

Brachycentridae (-0.096). For terrestrial invertebrates, the highest selection was for Simuliidae adult (+0.088) and the lowest was for Chironomidae adult (-0.079). For 1+ brown trout, the highest aquatic electivity was for Haliplidae (+0.093) and lowest was for Elmidae larvae (-0.079). For terrestrial invertebrates, the highest selection was for Simuliidae adult (+0.106) and the lowest was for Chironomidae adult (-0.071). For 2+ brown trout, Limnephilidae (+0.062) had the highest aquatic invertebrate electivity and Elmidae larvae (-0.091) had the lowest. For terrestrial invertebrates, the highest electivity was for Formicidae (+0.046) and the lowest was for Chironomidae adult (-0.071). For 3+ brown trout, aquatic selection was highest for Limnephilidae (+0.454) and lowest for Elmidae larvae (-0.091). For terrestrial invertebrates, the highest selection was for Formicidae (+0.074) and the lowest was for Chironomidae adult (-0.071). For 4+ brown trout, the highest aquatic electivity was for Limnephilidae (+0.694) and the lowest was for Brachycentridae (-0.096). The highest terrestrial invertebrate electivity was for Formicidae (+0.134) had the lowest was for Chironomidae adult (-0.071). For 5+ brown trout, aquatic invertebrate selection was highest for Limnephilidae (+0.380) and lowest for Brachycentridae (-0.096). For terrestrial invertebrates, the highest selection was for Aphididae (-0.040) and the lowest was for Chironomidae adult (-0.071).

Brook trout electivities for drifting invertebrates are listed in Table 3.130. Selection for aquatic invertebrates by 0+ brook trout was highest for Baetidae (+0.156) and was lowest for Elmidae larvae (-0.091). The highest terrestrial invertebrate electivity was for Glomeridae (+0.051) and the lowest was for Chironomidae adult (-0.071). For 1+ brook trout, the highest aquatic invertebrate electivity was for Hydracarina (+0.155) and the lowest was for Elmidae larvae (-0.084). The highest terrestrial invertebrate electivity was for Carabidae (+0.083) and the lowest was for Chironomidae adults (-0.071). For 2+ brook trout, aquatic invertebrate selection was highest for Limnephilidae (+0.973) and was lowest for Chironomidae larvae (-0.100). Terrestrial electivity values were all 0.0 or less, with the lowest being Chironomidae adults (-0.071). For 3+ brook trout, the highest aquatic electivity was for Limnephilidae (+0.573) and the lowest was for Chironomidae larvae (-0.100). Values for terrestrial invertebrates were all 0.0 or less with Chironomidae adults being the lowest (-0.071').

Table 3.129. The measure of prey selection **(electivity)** for macroinvertebrates (from drift samples) by each age class of brown trout in Cee Cee Ah Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=13	1+ N=14	2+ N=12	3+ N=6	4+ N=2	5+ N=l
TRICHOPTERA							
Hydropsychidae	2.1	-0.021	+0.001	+0.018	-0.021	-0.021	-0.021
Rhyacophilidae	1.9	-0.019	+0.032	-0.006	-0.019	+0.052	-0.019
Limnephilidae	2.7	+0.019	+0.050	+0.062	+0.454	+0.694	+0.380
Brachycentridae	9.6	-0.096	-0.016	+0.053	+0.025	-0.096	-0.096
Glossosomatidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Hydroptilidae	0.9	-0.001	+0.046	-0.006	-0.009	-0.009	-0.009
Lepidostomatidae	0.3	-0.003	+0.002	-0.003	-0.003	-0.003	-0.003
Psychomyiidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Helicopsychidae	0.1	-0.001	-0.001	-0.011	-0.001	-0.001	-0.001
EPHEMEROPTERA							
Ephemerellidae	7.2	-0.034	+0.025	-0.020	-0.072	-0.072	-0.072
Baetidae	7.7	+0.174	-0.004	+0.004	-0.077	-0.077	-0.007
Heptageniidae	1.6	+0.057	+0.075	-0.016	-0.016	-0.016	-0.016
Leptophlebiidae	0.1	-0.001	-0.001	-0.001	0.001	-0.001	-0.001
Tricorythidae	0.0	0.0	0.0	+0.013	0.0	0.0	0.0
DIPTERA							
Chironomidae Larvae	10.	-0.002	-0.022	-0.085	-0.062	-0.100	-0.100
Chironomidae pupae	1.2	-0.012	-0.012	+0.025	-0.012	-0.012	-0.012
Simuliidae	5.5	+0.035	+0.053	-0.052	-0.055	-0.055	-0.055
Tipulidae	1.5	-0.015	-0.015	-0.002	-0.015	-0.015	-0.015
Tabanidae	0.1	-0.001	-0.001	+0.039	+0.016	-0.001	-0.001
Psychodidae	0.6	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
Stratiomyidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Culicidae	0.3	-0.003	+0.007	-0.003	-0.003	-0.003	-0.003
Ceratopogonidae	0.0	+0.024	0.0	0.0	+0.017	0.0	0.0
PLECOPTERA							
Chloroperlidae	4.0	-0.040	-0.040	-0.040	-0.040	-0.040	-0.040
Perlidae	6.6	-0.066	-0.066	-0.066	-0.066	-0.066	-0.066
Perlodidae	0.0	+0.060	+0.018	0.0	0.0	0.0	0.0
Nemouridae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
COLEOPTERA							
Elmidae larvae	9.1	+0.015	-0.079	-0.091	-0.091	-0.091	-0.091
Elmidae adult	1.5	+0.006	+0.001	-0.011	+0.061	-0.015	-0.015
Psephenidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Haliplidae	0.0	0.0	+0.093	+0.007	+0.017	0.0	0.0
HEMIPTERA							
Gerridae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
HYDRACARINA	3.8	-0.038	-0.038	-0.038	-0.038	-0.038	-0.038
OSTRACODA	2.4	-0.024	-0.024	-0.024	-0.024	-0.024	-0.024
OLIGOCHAETA	1.0	+0.011	-0.005	+0.055	-0.010	+0.061	-0.010
GASTRAPODA	0.6	+0.009	+0.030	+0.019	+0.012	-0.008	-0.008
BIVALVIA							
Sphaeriidae	6.5	-0.057	-0.047	-0.065	-0.013	-0.065	-0.065

Table 3.129. (cont.)

Terrestrial Oraanisms	% Composition in Environment	0+ N=13	1+ N=14	2+ N=12	3+ N=6	4+ N=2	5+ N=1
TRICHOPTERA adult	0.0	0.0	0.0	0.0	+0.017	0.0	0.0
DIPTERA							
Chironomidae	7.1	-0.071	-0.071	-0.071	-0.071	-0.071	-0.071
Simuliidae	0.2	+0.088	+0.106	+0.001	-0.002	-0.002	-0.002
Empididae	0.2	0.0	+0.005	+0.002	0.0	-0.002	-0.002
Sciaridae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
Mycetophilidae	0.0	0.0	0.0	+0.001	0.0	0.0	0.0
Anthomyzidae	0.0	0.0	0.0	+0.005	0.0	0.0	0.0
Muscidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
Dolichopodidae	0.0	0.0	0.0	+0.005	0.0	0.0	0.0
Dryomyzidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
PLECOPTERA adult	0.0	0.0	+0.009	0.0	0.0	0.0	0.0
COLEOPTERA							
Buprestidae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Carabidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
Staphylinidae	0.0	+0.008	0.0	+0.007	0.0	0.0	0.0
HEMIPTERA							
Pentotomidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
Nabidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
Adelgidae	0.0	0.0	0.0	+0.002	0.0	0.0	0.0
HOMOPTERA							
Aphididae	4.0	-0.040	-0.040	-0.010	0.0	-0.040	-0.040
Cicadellidae	0.0	0.0	+0.002	+0.023	+0.021	0.0	0.0
Cercopidae	0.0	0.0	0.0	+0.010	0.0	0.0	0.0
Psocoptera							
Psocidae	0.6	+0.018	-0.006	-0.006	+0.015	-0.006	-0.006
HYMENOPTERA							
Formicidae	0.2	+0.022	+0.004	+0.046	+0.074	+0.134	-0.002
Apidae	0.4	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
ORTHOPTERA	0.0	0.0	+0.002	+0.017	0.0	0.0	0.0
THYSANURA	0.0	0.	0.0	+0.002	0.0	0.0	0.0
ARANEIDA	0.0	0.0	0.0	+0.004	0.0	0.0	0.0

Table 3.130. The measure of prey selection **(electivity)** for macroinvertebrates (from drift samples) by each age class of brook trout in Cee Cee Ah Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=9	1+ N=16	2+ N=1	3+ N=1
TRICHOPTERA					
Hydropsychidae	2.1	+0.005	-0.021	-0.021	-0.021
Rhyacophilidae	1.9	+0.106	+0.077	-0.019	-0.019
Limnephilidae	2.7	+0.110	+0.116	+0.973	+0.573
Bracnycentridae	9.6	-0.074	-0.063	-0.096	-0.096
Glossosomatidae	0.1	-0.001	-0.001	-0.001	-0.001
Hydroptilidae	0.9	-0.009	-0.009	-0.009	-0.009
Lepidostomatidae	0.3	-0.003	-0.003	-0.003	-0.003
Psychomyiidae	0.1	-0.001	-0.001	-0.001	-0.001
Helicopsychidae	0.1	-0.001	-0.001	-0.001	-0.001
EPHEMEROPTERA					
Ephemerellidae	7.2	+0.050	-0.072	-0.072	-0.072
Baetidae	7.7	+0.156	-0.029	-0.077	-0.077
Heptageniidae	1.6	-0.016	-0.011	-0.046	-0.016
Leptophlebiidae	0.1	-0.001	-0.001	-0.001	-0.001
DIPTERA					
Chironomidae larvae	10.0	+0.026	-0.020	-0.100	-0.100
Chironomidae pupae	1.2	-0.012	-0.012	-0.012	-0.012
Simuliidae	5.5	-0.055	-0.021	-0.055	-0.055
Tipulidae	1.5	-0.015	-0.008	-0.015	-0.015
Tabanidae	0.1	-0.001	-0.001	-0.001	-0.001
Psychodidae	0.6	-0.006	-0.006	-0.006	-0.006
Stratiomyidae	0.1	-0.001	-0.001	-0.001	-0.001
Culicidae	0.3	-0.003	-0.003	-0.003	-0.003
PLECOPTERA					
Chloroperlidae	0.0	0.0	+0.083	0.0	0.0
Perlidae	6.6	-0.066	-0.066	-0.066	-0.066
Perlodidae	0.0	+0.040	+0.028	0.0	0.0
Nemouridae	0.3	-0.003	+0.025	-0.003	-0.003
Peltoperlidae	0.0	+0.013	+0.014	0.0	0.0
COLEOPTERA					
Elmidae larvae	9.1	-0.091	-0.084	-0.091	-0.091
Elmidae adult	1.5	-0.015	-0.008	-0.015	-0.015
Psephenidae	0.1	-0.001	-0.001	-0.001	-0.001
HYDRACARINA	3.6	+0.097	+0.155	-0.036	-0.068
OSTRACODA	2.4	-0.024	-0.024	-0.024	-0.024
OLIGOCHAETA	1.0	+0.003	-0.005	-0.010	-0.010
GASTROPODA	0.8	-0.008	-0.008	-0.008	-0.008
BIVALVIA					
Sphaeriidae	6.5	-0.065	-0.051	-0.065	-0.065
LEPIDOPTERA					
Pyralidae	0.0	0.0	+0.007	0.0	0.0

Table 3.130. (cont.)

Terrestrial Organisms	% Composition in Environment	0+ N=9	1+ N=16	2+ N=1	3+ N=1
TRICHOPTERA adult	0.0	0.0	+0.007	0.0	0.0
DIPTERA					
Chironomidae	7.1	-0.071	-0.071	-0.071	-0.071
Simuliidae	0.2	-0.002	-0.002	-0.002	-0.002
Empididae	0.2	-0.002	-0.002	-0.002	-0.002
Sciaridae	0.0	+0.009	0.0	0.0	0.0
Dixidae	0.0	0.0	+0.007	0.0	0.0
PLECOPTERA adult	0.0	0.0	+0.007	0.0	0.0
COLEOPTERA					
Buprestidae	0.3	-0.003	-0.003	-0.003	-0.003
Carabidae	0.0	0.0	+0.083	0.0	0.0
Scarabaeidae	0.0	0.0	+0.010	0.0	0.0
HEMIPTERA					
Nabidae	0.0	0.0	+0.007	0.0	0.0
HOMOPTERA					
Aphididae	4.0	-0.018	-0.040	-0.040	-0.040
Cicadellidae	0.0	0.0	+0.012	0.0	0.0
PSOCOPTERA					
Psocidae	0.6	-0.006	-0.006	-0.006	-0.006
HYMENOPTERA					
Formicidae	0.2	+0.007	+0.005	-0.002	-0.002
Apidae	0.4	-0.004	+0.003	-0.004	-0.004
Ichneumonidae	0.0	+0.009	0.0	0.0	0.0
LEPIDOPTERA	0.0	0.0	+0.007	0.0	0.0
GLOMERIDA	0.0	+0.051	+0.012	0.0	0.0

3.5.6.3 TACOMA CREEK

The measure of prey selection (electivity) for both aquatic and terrestrial drifting invertebrates was determined for each age class of brook trout and cutthroat trout captured in Tacoma Creek.

Brook trout electivities for drifting invertebrates are listed in Table 3.131. Selection for aquatic invertebrates by 0+ brook trout was highest for Nemouridae (+0.152) and lowest for Elmidae adult (-0.228). For terrestrial invertebrates, the highest electivity was for Psocidae (+0.052) and the lowest was for Chironomidae adult (-0.037). For 1+ brook trout, the highest aquatic electivity was for Brachycentridae (+0.082) and the lowest was for Elmidae adult (-0.187). For terrestrial invertebrates, the highest electivity was for Formicidae (+0.031) and the lowest was for Chironomidae adults (-0.037). For 2+ brook trout, the highest aquatic electivity was for Baetidae (+0.093) and the lowest was for Elmidae adult (-0.222). For terrestrial invertebrates, the highest selection was for Aphididae (+0.162) and the lowest was for Psocidae (-0.008).

Cutthroat trout electivities for drifting invertebrates are listed in Table 3.132. Selection for aquatic invertebrates by 0+ cutthroat trout was highest for Chironomidae larvae (+0.253) and lowest for Elmidae adult (-0.247). For terrestrial invertebrates, all values were 0.0 or less with the lowest for Aphididae (-0.038). For 1+ cutthroat trout, the highest aquatic electivity was for Brachycentridae (+0.196) and the lowest value was for Chironomidae pupae (-0.144). All values for terrestrial invertebrates were less than 0.0 with the lowest for Aphididae (-0.038). For 2+ cutthroat trout, the highest aquatic electivity was for Baetidae (+0.139) and the lowest was for Elmidae adult (-0.247). For terrestrial invertebrates, Chironomidae adult had the highest electivity (+0.305) and Mycetophilidae had the lowest (-0.073).

3.5.6.4 LECLERC CREEK

The measure of prey selection (electivity) for both aquatic and terrestrial drifting invertebrates was determined for each age class of brown trout, brook trout, cutthroat trout and mountain whitefish captured in LeClerc Creek.

Brown trout electivities for drifting invertebrates are listed in Table 3.133. Selection for aquatic invertebrates by 0+ brown trout was highest for Chironomidae larvae (+0.174) and lowest for

Table 3.131. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of brook trout in Tacoma Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=20	1+ N=25	2+ N=6
TRICHOPTERA				
Hydropsychidae	0.9	+0.023	+0.014	-0.009
Rhyacophilidae	0.3	-0.003	+0.007	+0.039
Limnephilidae	0.5	+0.006	+0.023	+0.053
Brachycentridae	2.9	+0.128	+0.082	+0.074
Hydroptilidae	0.0	0.0	+0.018	0.0
EPHEMEROPTERA				
Ephemerellidae	8.9	-0.032	-0.055	-0.047
Baetidae	3.2	+0.013	+0.029	+0.093
Heptageniidae	0.0	+0.003	+0.020	+0.0
DIPTERA				
Chironomidae larvae	8.0	+0.121	-0.014	-0.080
Chironomidae pupae	17.6	-0.110	-0.176	-0.176
Simuliidae	5.2	+0.007	+0.044	-0.052
Tipulidae	0.0	+0.003	0.0	0.0
Ceratopogonidae	0.0	+0.004	+0.003	0.0
Tabanidae	0.0	0.0	+0.001	0.0
Empididae	0.0	+0.007	0.0	0.0
Psychodidae	0.3	-0.003	-0.003	-0.003
PLECOPTERA				
Perlodidae	0.0	0.0	+0.010	0.0
Nemouridae	0.0	+0.152	+0.079	0.0
COLEOPTERA				
Elmidae larvae	9.2	-0.092	-0.092	-0.092
Elmidae adult	24.7	+0.228	+0.187	+0.222
HEMIPTERA				
Corixidae	0.0	0.0	+0.004	0.0
HYDRACARINA	4.0	-0.029	-0.035	0.0
OLIGOCHAETA	0.4	+0.022	+0.008	+0.055
GASTROPODA	0.1	-0.001	-0.001	-0.001
BIVALVIA	0.2	+0.002	+0.001	-0.002

Table 3.131. (cont.)

Terrestrials Organisms	% Composition in Environment	0+ N=20	1+ N=25	2+ N=6
TRICHOPTERA adult	0.0	+0.003	+0.005	0.0
DIPTERA				
Chironomidae	3.7	-0.037	-0.037	+0.171
COLEOPTERA				
Carabidae	0.0	0.0	+0.007	+0.100
HEMIPTERA				
Pentatomidae	0.0	0.0	+0.004	0.0
Mesoveliidae	0.2	-0.002	-0.002	-0.002
HOMOPTERA				
Aphididae	3.8	0.0	-0.024	+0.162
Cicadellidae	0.0	+0.004	0.0	+0.008
PSOCOPTERA				
Psocidae	0.8	+0.052	-0.008	-0.008
HYMENOPTERA				
Formicidae	0.0	0.0	+0.031	+0.017
Sphecidae	0.2	-0.002	-0.002	-0.002
ARANEIDA	0.0	0.0	+0.005	+0.042
LEPIDOPTERA	0.2	+0.001	-0.001	-0.002

Table 3.132. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of cutthroat trout in Tacoma Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=2	1+ N=5	2+ N=4
TRW-KM-ERA				
Hydropsychidae	0.9	**+0.158**	**+0.028**	-0.009
Rhyacophilidae	0.3	-0.003	-0.003	-0.003
Limnephilidae	0.5	**+0.162**	-0.005	-0.005
Brachycentridae	2.9	-0.029	**+0.196**	-0.004
Hydroptilidae	0.0	0.0	**+0.048**	0.0
EPHEMEROPTERA				
Ephemerellidae	8.9	-0.089	-0.024	-0.089
Baetidae	3.2	-0.032	-0.005	**+0.139**
Heptageniidae	0.0	0.0	**+0.032**	0.0
DIPTERA				
Chironomidae larvae	8.0	**+0.253**	-0.038	-0.031
Chironomidae pupae	17.6	-0.176	-0.144	-0.176
Simuliidae	5.2	-0.052	-0.042	-0.052
Tipulidae	0.0	0.0	**+0.016**	0.0
Psychodidae	0.3	-0.003	-0.003	-0.003
PLECOPTERA				
Perlodidae	0.0	0.0	**+0.097**	0.0
COLEOPTERA				
Elmidae larvae	9.2	**+0.241**	-0.018	**+0.043**
Elmidae adult	24.7	-0.247	-0.092	-0.247
LEPIDOPTERA				
Pyralidae	0.2	-0.002	-0.002	-0.002
HYDRACARINA	4.0	-0.040	-0.040	-0.040
OLIGOCHAETA	0.4	-0.004	-0.004	-0.004
GASTROPODA	0.1	-0.001	-0.001	-0.001
BIVALVIA	0.2	-0.002	-0.002	-0.002

Table 3.132. (cont.)

Terrestrials Organisms	% Composition in Environment	0+ N=2	1+ N=5	2+ N=4
TRICHOPTERA adult	0.0	0.0	0.0	+0.049
DIPTERA				
Chironomidae	3.7	-0.037	-0.037	+0.305
Mycetophilidae	0.0	0.0	0.0	-0.073
Sciarida	0.0	0.0	0.0	+0.024
Simuliidae	0.10	0.0	0.0	+0.024
Tabanidae	0.0	0.0	0.0	+0.024
HEMIPTERA				
Mesoveliidae	0.2	-0.002	-0.002	-0.002
HOMOPTERA				
Aphididae	3.8	-0.038	-0.038	-0.038
PSOCOPTERA				
Psocidae	0.8	-0.008	-0.008	-0.008
HYMENOPTERA				
Formicidae	0.0	0.0	0.0	+0.098
Ichneumonidae	0.0	0.0	0.0	+0.073
Sphecidae	0.2	-0.002	-0.002	-0.002

Nemouridae at (-0.088). For terrestrial invertebrates, the highest electivity was for Tabanidae (+0.083) and the lowest was for Chironomidae adult (-0.071). For 1+ brown trout, the highest aquatic electivity was for Limnephilidae (+0.228) and the the lowest was for Nemouridae (-0.088). For terrestrial invertebrates, the highest selection was for Formicidae (+0.150) and the lowest was for Chironomidae adult (-0.071). For 2+ brown trout, the highest aquatic invertebrate electivity was for Ephemerellidae (+0.182) and the lowest was for Chironomidae larvae (-0.167). For terrestrial invertebrates, the highest electivity was for Lepidoptera (+0.027) and the lowest was for Chironomidae adult (-0.071). For 3+ brown trout, the highest aquatic electivity was for Limnephilidae (+0.240) and the lowest was for Chironomidae larvae (-0.167). For terrestrial invertebrates the highest electivity was +0.056 for Pentatomidae, Cicadellidae, and Arachnidae and the lowest was -0.071 for Chironomidae adult. For 4+ brown trout, electivity for aquatic invertebrates was greatest for Limnephilidae (+0.183) and lowest for Chironomidae larvae (-0.167). For terrestrial invertebrates, the highest electivity was for Lepidoptera (+0.192) and the lowest was for Chironomidae adult (-0.071).

Brook trout electivities for drifting invertebrates are listed in Table 3.134. Electivity for aquatic invertebrates by 0+ brook trout' was highest for Chironomidae larvae (+0.355) and was lowest for Nemouridae (-0.088). For terrestrial invertebrates, the highest electivity was for Formicidae (+0.032) and the lowest was for Chironomidae adult (-0.071). For 1+ brook trout, the highest aquatic electivity was for Limnephilidae (+0.187) and the lowest was for Nemouridae (-0.088). For terrestrial invertebrates, the highest electivity was for Lepidoptera (+0.115) and the lowest was for Chironomidae adult (-0.071). For 2+ brook trout, the highest aquatic invertebrate electivity was for Limnephilidae (+0.512) and the lowest was for Chironomidae larvae (-0.116). The highest terrestrial electivity was for Empididae adult (+0.066) and the lowest was for Chironomidae adult (-0.071).

Cutthroat trout electivities for drifting invertebrates are listed in Table 3.135. Only a single 2+ cutthroat trout was caught in LeClerc Creek in 1988. For aquatic invertebrates, the highest electivity was for Pyralidae (+0.024) and the lowest was for Chironomidae larvae (-0.167). The highest terrestrial invertebrate electivity was for Empididae adult (+0.220) and the lowest electivity was for Chironomidae adult (-0.071).

Table 3.133. The measure of prey selection **(electivity)** for macroinvertebrates (from drift samples) by each age class of brown trout in **LeClerc** Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=6	1+ N=7	2+ N=10	3+ N=6	4+ N=3
TRICHOPTERA						
Hydropsychidae	0.2	-0.002	-0.002	+0.004	-0.002	-0.002
Rhyacophilidae	6.4	-0.064	-0.073	-0.038	-0.064	+0.008
Limnephilidae	1.0	-0.010	+0.228	+o. 120	+0.240	+O. 183
Brachycentridae	7.6	-0.076	+0.041	+0.130	-0.020	+0.117
Glossosomatidae	0.5	-0.005	-0.005	-0.005	-0.005	-0.005
Hydroptilidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001
Leptoceridae	0.6	-0.006	-0.006	-0.006	-0.006	+0.007
Philopotamidae	0.3	-0.003	-0. 003	-0.003	-0.003	-0.003
EPHEMEROPTERA						
Ephemerellidae	5.4	+0.057	+0.,028	+0.182	-0.037	-0.042
Baetidae	8.8	+0.021	-0.055	+0.024	-0.071	-0.076
Heptageniidae	4.4	-0.017	-0.032	-0.032	-0.044	-0.044
Leptophlebiidae	0.4	-0.004	-0. 004	-0.004	-0.004	-0.004
DIPTERA						
Chironomidae larv.	16.7	+0.174	-0.037	-0.187	-0.167	-0.167
Chironomidae pupae	3.5	-0.0:35	-0.035	-0.035	-0.035	-0.035
Simuliidae	1.7	-0.017	-0.017	+0.066	-0.017	-0.017
Tipulidae	0.3	-0.003	-0.003	-0.003	-0.003	+0.009
Ceratopogonidae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
Psychodidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001
Muscidae	0.0	0.000	0.000	0.000	-0.111	0.000
PLECOPTERA						
Chloroperlidae	2.0	-0.020	-0.020	-0.020	-0.020	-0.020
Perlidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001
Perlodidae	4.3	-0.043	-0.024	-0.037	-0 043	-0.043
Nemouridae	8.8	-0.088	-0.088	-0.088	-0.088	-0.088
Peltoperlidae	2.1	-0.021	-0.021	-0.021	-0.021	-0.021
Leuctridae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003
Coleoptera						
Elmidae larvae	0.0	0.000	0.000	+0.016	+0.017	0.000
Elmidae adult	0.0	0.000	0.000	+0.056	+0.056	0.000
HEMIPTERA						
Gerridae	0.3	-0.003	-0.003	-0.003	-0.003	-0.003
Hydracarina	2.2	+0.103	-0.022	-0.022	-0.022	-0.022
Oligochaeta	1.1	-0.011	-0.011	-0.055	-0.011	-0.011
NEMATODA	0.2	-0.002	-0.002	-0.002	-0.002	+0.010
TURBELLARIA						
Planariidae	0.5	-0.005	-0.005	-0.005~	-0.005	-0.005
GASTROPODA	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
BIVALVIA						
Sphaeriidae	0.2	-0 on7	-0.002	-0.002	-0.002	-0.002

Table 3.133. (cont.)

Terrestrial Organisms	% Composition in Environment	0 + N=6	1 + N=7	2 + N=10	3 + N=6	4 + N=3
TRICHOPTERA adult	0.1	-0.001	-0.001	-0.001	+0.016	+0.011
EPHEMEROPTERA adult	3.0	-0.030	-0.030	-0.030	-0.030	-0.030
DIPTERA						
Chironomidae	7.1	-0.071	-0.071	-0.071	-0.071	-0.071
Simuliidae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
Empididae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
Mycetophilidae	0.0	0.0	0.0	+0.009	0.0	0.0
Tabanidae	0.0	+0.083	0.0	0.0	0.0	0.0
COLEOPTERA						
Carabidae	0.0	0.0	0.0	0.0	+0.017	0.0
Staphylinidae	0.0	0.0	0.0	0.0	0.0	+0.012
Cerambycidae	0.1	-0.001	-0.001	+0.004	0.0	+0.011
HEMIPTERA						
Pentatomidae	0.0	0.0	0.0	0.0	+0.056	0.0
HOMOPTERA						
Aphididae	4.7	-0.047	-0.047	-0.047	-0.047	-0.047
Cicadellidae	0.0	0.0	0.0	0.0	+0.056	0.0
PSOCOPTERA						
Psocidae	0.8	-0.008	-0.008	-0.008	-0.008	-0.008
Polypsocidae	0.2	-0.002	-0.002	-0.002	-0.002	-0.002
HYMENOPTERA						
Formicidae	0.2	+0.048	+0.150	+0.014	+0.031	+0.035
Apidae	0.4	-0.004	-0.004	-0.004	-0.004	-0.004
LEPIDOPTERA	0.0	+0.025	0.0	+0.027	0.0	+0.192
ARANEIDA						
Arachnida	0.0	0.0	0.0	0.0	+0.056	0.0

Table 3.134. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of brook trout in LeClerc Creek for 1988.

Aquatic Organisms	% Composition in Environment	0+ N=12	1+ N=18	2+ N=5
TRICHOPTERA				
Hydropsychidae	0.2	0.0	-0.002	-0.002
Rhyacophilidae	6.4	-0.064	-0.042	-0.064
Limnephilidae	1.0	+0.029	+0.187	+0.512
Brachycentridae	7.6	-0.001	+0.109	-0.031
Glossosomatidae	0.5	-0.005	-0.005	+0.007
Hydroptilidae	0.1	-0.001	-0.001	-0.001
Leptoceridae	0.6	-0.006	-0.006	-0.006
Philapotamidae	0.3	-0.003	-0.003	-0.003
EPHEMEROPTERA				
Ephemerellidae	5.4	-0.048	-0.040	-0.054
Baetidae	8.8	-0.057	0.0	-0.076
Heptageniidae	4.4	-0.044	-0.038	-0.044
Leptophlebiidae	0.4	-0.004	-0.004	-0.004
DIPTERA				
Chironomidae larvae	16.7	+0.355	-0.025	-0.116
Chironomidae pupae	3.5	-0.035	-0.035	-0.035
Simuliidae	1.7	+0.066	-0.011	-0.017
Tipulidae	0.3	-0.003	-0.003	-0.003
Ceratopogonidae	0.2	-0.002	-0.002	-0.002
Psychodidae	0.1	-0.001	-0.001	-0.001
PLECOPTERA				
Chloroperlidae	2.0	-0.020	-0.020	-0.020
Perlidae	0.1	-0.001	-0.001	-0.001
Perlodidae	4.3	-0.043	-0.043	-0.031
Nemouridae	8.8	-0.088	-0.088	-0.088
Peltoperlidae	2.1	-0.021	-0.021	-0.021
Leuctridae	0.3	-0.003	-0.003	-0.003
COLEOPTERA				
Elmidae larvae	0.0	+0.002	+0.005	+0.007
Elmidae adult	0.0	+0.020	+0.017	+0.007
Amphizoidae	0.0	0.0	+0.025	0.0
HYDRACARINA	2.2	+0.002	-0.022	-0.008
OLIGOCHAETA	1.1	-0.011	-0.011	-0.004
NEMATODA	0.2	-0.002	-0.002	-0.002
TURBELLARIA				
Planariidae	0.5	-0.005	-0.005	-0.005
GASTROPODA	0.2	-0.002	+0.001	-0.002
BIVALVIA				
Sphaeriidae	0.2	-0.002	-0.002	-0.002

Table 3.134. (cont.)

Terrestrials Organisms	% Composition in Environment	0+ N=12	1+ N=18	2+ N=5
TRICHOPTERA adult	0.1	+0.006	+0.034	-0.001
EPHEMEROPTERA adult	3.0	-0.030	-0.030	-0.030
DIPTERA				
Chironomidae	7.1	-0.071	-0.071	-0.071
Simuliidae	0.2	-0.002	-0.002	-0.002
Empididae	0.2	+0.029	[illegible]	+0.066
COLEOPTERA				
Caribidae	0.0	0.0	+0.020	0.0
Scaribidae	0.0	0.0	+0.006	0.0
Cerambycidae	0.1	-0.001	-0.001	-0.001
HEMIPTERA				
Nabidae	0.0	0.0	0.0	+0.007
HOMOPTERA				
Aphididae	4.7	+0.026	+0.020	+0.028
Cicadellidae	0.0	+0.002	+0.003	0.0
Cercopidae	0.0	0.0	+0.003	+0.006
PSOCOPTERA				
Psocidae	0.8	-0.008	-0.008	-0.008
Polypsocidae	0.2	-0.002	-0.002	-0.002
HYMENOPTERA				
Formicidae	0.2	+0.032	+0.006	+0.001
Apidae	0.4	+0.007	-0.004	+0.003
Ichneumonidae	0.0	+0.011	0.0	+0.035
Specidae	0.0	0.0	0.0	+0.012
LEPIDOPTERA	0.0	0.0	+0.115	+0.006
ARANEIDA				
Arachnidae	0.0	+0.004	+0.020	0.0
COLEMBOLA	0.0	+0.002	0.0	0.0
NEUROPTERA	0.0	+0.002	0.0	0.0
GLOMERIDA	0.0	0.0	0.0	+0.007

Table 3.135. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of cutthroat trout in LeClerc Creek for 1988.

Aquatic Organisms	% Composition in Environment	2+ N=1
TRICHOPTERA		
Hydropsychidae	0.2	-0.002
Rhyacophilidae	6.4	-0.064
Limnephilidae	1.0	-0.010
Brachycentridae	7.6	-0.076
Glossosomatidae	0.5	-0.005
Hydroptilidae	0.1	-0.001
Leptoceridae	0.6	-0.006
Philapotamidae	0.3	-0.003
EPHEMEROPTERA		
Ephemerellidae	5.4	+0.019
Baetidae	8.8	-0.088
Heptageniidae	4.4	-0.044
Leptophlebiidae	0.4	-0.004
DIPTERA		
Chironomidae larvae	16.7	-0.167
Chironomidae pupae	3.5	-0.035
Simuliidae	1.7	-0.017
Tipulidae	0.3	-0.007
Ceratopogonidae	0.2	-0.002
Psychodidae	0.1	-0.001
PLECOPTERA		
Chloroperlidae	2.0	-0.020
Perlidae	0.1	-0.001
Perlodidae	4.3	-0.043
Nemouridae	8.8	-0.088
Peltoperlidae	2.1	-0.021
Leuctridae	0.3	-0.003
COLEOPTERA		
Elmidae adult	0.0	-0.024
HEMIPTERA		
Gerridae	0.3	-0.003
HYDRACARINA	2.2	-0.022
OLIGOCHAETA	1.1	-0.011
NEMATODA	0.2	-0.002
TURBELLARIA		
Planariidae	0.5	-0.005
GASTROPODA	[illegible]	-0.302
BIVALVIA		
Sphaeriidae	0.2	-0.002
LEPIDOPTERA		
Pyralidae	0.0	+0.024

Table 3.135. (cont.)

Terrestrials Organisms	% Composition in Environment	2+ N=1
TRICHOPTERA adult	0.1	+0.023
EPHEMEROPTERA adult	3.0	-0.030
DIPTERA		
Chironomidae	7.1	-0.071
Simuliidae	0.2	-0.002
Empididae	0.2	+0.220
Bibionidae	0.0	+0.024
COLEOPTERA		
Cerambycidae	0.1	-0.001
HOMOPTERA		
Aphididae	4.7	+0.026
PSOCOPTERA		
Psocidae	0.8	-0.008
Polypsocidae	0.2	-0.002
HYMENOPTERA		
Formicidae	0.2	+0.193
Apidae	0.4	-0.004
Ichneumonidae	0.0	+0.098
Chalcidae	0.0	+0.024
ARANEIDA		
Arachnidae	0.0	+0.024
COLLEMBOLA	0.0	+0.024
NEUROPTERA	0.0	+0.024

Mountain whitefish electivities for drifting invertebrates are listed in Table 3.136. Selection by 3+ mountain whitefish for aquatic invertebrates was highest for Limnephilidae (+0.835) and lowest for Chironomidae larvae (-0.127). For terrestrial invertebrates, the highest electivity was for Lepidoptera (+0.001) and the lowest was for Chironomidae adult (-0.071). For 4+ mountain whitefish, the highest electivity was for Limnephilidae (+0.059) and the lowest was for Chironomidae larvae (-0.167). For terrestrial invertebrates, electivity values ranged from 0.0 to a low of -0.071 for Chironomidae adult.

3.5.7 DIET OVERLAPS

Diet overlaps were determined for fish species captured in Skookum Creek, Cee Cee Ah Creek, Tacoma Creek, and Le Clerc Creek. Overlaps were calculated to compare the extent of similarity in food selection between species and between the different age classes of each species. High overlaps are ≥ 0.7 and indicate a large proportion of shared food. In general, diet overlaps in the four Pend Oreille River tributaries were moderate (20.50) to low (<0.50).

3.5.7.1 SKOOKUM CREEK

Table 3.137 presents the extent of diet overlap between brown trout, brook trout, and cutthroat trout in Skookum Creek. Brown trout overlapped only moderately with brook trout (0.633) and low with cutthroat trout (0.385). Brook trout and cutthroat trout overlapped only moderately (0.625).

For overlaps between the different age classes of brown trout, significant overlaps occurred only between 0+ and 1+ brown trout (0.849). Lowest overlap occurred between 1+ and 3+ brown trout (0.060).

No significant overlaps occurred between the different age classes of brook trout. Overlap values ranged from a low of 0.281 between 0+ and 1+ brook trout to a high of 0.429 between 0+ and 2+ trout.

Cutthroat trout had no significant overlaps between age classes. Moderate overlaps occurred between 1+ and 2+ age groups (0.652). Lowest overlap occurred between 0+ and 2+ brook trout (0.119).

Table 3.136. The measure of prey selection (electivity) for macroinvertebrates (from drift samples) by each age class of mountain whitefish in LeClerc Creek for 1988.

Aquatic Organisms	% Composition in Environment	3+ N=3	4+ N=1
TRICHOPTERA			
Hydropsychidae	0.2	0.0	-0.002
Rhyacophilidae	6.4	-0.063	-0.049
Limnephilidae	1.0	+0.835	+0.059
Brachycentridae	7.6	-0.032	-0.076
Glossosomatidae	0.5	-0.005	-0.005
Hydroptilidae	0.1	-0.001	-0.001
Leptoceridae	0.6	-0.006	-0.006
Philopotamidae	0.3	-0.003	-0.003
EPHEMEROPTERA			
Ephemerellidae	5.4	-0.046	-0.052
Baetidae	8.8	-0.037	-0.086
Heptageniidae	4.4	-0.039	-0.036
Leptophlebiidae	0.4	-0.004	-0.004
DIPTERA			
Chironomidae larv	16.7	-0.127	-0.167
Chironomidae pupae	3.5	-0.035	-0.035
Simuliidae	1.7	+0.016	-0.017
Tipulidae	0.3	-0.003	-0.003
Ceratopogonidae	0.2	-0.002	-0.002
Psychodidae	0.1	-0.001	-0.001
PLECOPTERA			
Chloroperlidae	2.0	-0.020	-0.020
Perlidae	0.1	-0.001	-0.001
Perlodidae	4.3	-0.040	-0.043
Nemouridae	8.8	-0.088	-0.088
Peltoperlidae	2.1	-0.021	-0.021
Leuctridae	0.3	-0.003	-0.003
HEMIPTERA			
Gerridae	0.3	-0.003	-0.003
HYDRACARINA	2.2	-0.022	-0.022
OLIGOCHAETA	1.1	-0.011	-0.001
NEMATODA	0.2	-0.002	-0.002
TURBELLARIA			
Planariidae	0.5	-0.005	-0.005
GASTROPODA	0.2	-0.002	-0.002
BIVALVIA			
Sphaeriidae	0.2	-0.002	-0.002

Table 3.136. (cont.)

Terrestrial Oraanisms	% Composition in Environment	3+ N=3	4+ N=1
TRICHOPTERA adult	0.1	-0.001	-0.001
EPHEMEROPTERA adult	3.0	-0.030	-0.030
Diptera			
Chironomidae	7.1	-0.071	-0.071
Simuliidae	0.2	-0.002	-0.002
Empididae	0.2	-0.002	-0.002
Coleoptera			
Cerambycidae	0.1	-0.001	-0.001
Homoptera			
Aphididae	4.7	-0.047	-0.047
Psocoptera			
Psocidae	0.8	-0.008	-0.008
Polypsocidae	0.2	-0.002	-0.002
Hymenoptera			
Formicidae	0.2	-0.002	-0.002
Apidae	0.4	-0.004	-0.004
Lepidoptera	0.0	+0.001	0.0

Table 3.137. Annual diet overlaps between trout species in Skookum Creek, WA. Overlaps based on relative importance values for 1988.

SPECIES OVERLAPS

	Brown trout	Brook trout	Cutthroat trout
Brown trout	1.0	0.633	0.385
Brook trout		1.0	0.625
Cutthroat trout			1.0

BROWN TROUT AGE OVERLAPS

	□ ☑	1+	2+	3+
o+	1.0	0.849	0.317	0.199
1+		1 .0	0.354	0.060
2+			1 .0	0.247
3+				1.0

BROOK TROUT AGE OVERLAPS

	0+	1+	2+
0+	1.0	0.379	0.429
1+		1.0	0.281
2+			1.0

CUTTHROAT TROUT AGE OVERLAPS

	0+	1+	2+
0+	1.0	0.197	0.119
1+		1.0	0.652
2+			1.0

3.k7.2 CEE CEE AH CREEK

Table 3.138 presents the extent of diet overlap between brown trout and brook trout in Cee Cee Ah Creek. Brown trout overlapped significantly with brook trout (0.907).

Brown trout had significant overlaps between 4+ and 5+ age classes (0.760). Moderate overlaps occurred between 0+ and 1+ age classes (0.597) 1+ and 2+ age classes (0.645), and 2+ and 4+ age classes (0.505). Lowest overlaps were between the 0+ and the 5+ brown trout (0.024).

Brook trout had no significant overlaps between the different age classes. Moderate overlaps were between the 0+ and 1+ age classes (0.682) and between 2+ and 3+ age classes (0.568). Lowest overlaps occurred between 1+ and 2+ brook trout (0.131).

3.5.7.3 TACOMA CREEK

Table 3.139 presents the extent of diet overlap between brook trout and cutthroat trout in Tacoma Creek. Brook trout overlapped only moderately with cutthroat trout (0.547).

There were no significant overlaps between the different age classes of brook trout. Moderate overlaps occurred between the 0+ and the 1+ age classes (0.638). The lowest overlap was 0.241 between 0+ and 2+ brook trout.

Cutthroat trout experienced no significant overlaps between the different age classes. The highest overlap value was 0.422 between 0+ and 1+ age classes and the lowest was 0.138 between 0+ and 2+ age classes.

3.5.7.4 LE CLERC CREEK

Table 3.140 presents the extent of diet overlap between brown trout, brook trout, cutthroat trout, and mountian whitefish in LeClerc Creek. Brown trout overlapped moderately with brook trout (0.678) and mountian whitefish (0.681). Brook trout overlapped moderately with mountain whitefish (0.657). The least amount of overlap was between cutthroat trout and mountain whitefish **(0.057).** For diet overlaps between the different age classes of brown trout, significant overlaps occurred only between 2+ and 4+ trout (0.724). The 1+ age class overlapped moderately with 2+ (0.540) with 4+ (0.574) age classes and the 3+ age class overlapped

Table 3.138. Annual diet overlaps between trout species in Cee Cee Ah Creek, WA. Overlaps based on relative importance values for 1988.

SPECIES OVERLAPS

	Brown trout	Brook trout
Brown trout	1.0	0.907
Brook trout		1.0

BROWN TROUT AGE OVERLAPS

	0+	1+	2+	3+	4+	5+
0+	1.0	0.597	0.410	0.174	0.113	0.024
1+		1.0	0.645	0.422	0.202	0.104
2+			1.0	0.362	0.505	0.281
3+				1.0	0.412	0.181
4+					1.0	0.760
5+						1.0

BROOK TROUT AGE OVERLAPS

	0+	1+	2+	3+
0+	1.0	0.682	0.184	0.271
1+		1.0	0.131	0.253
2+			1.0	0.568
3+				1.0

Table 3.139. Annual diet overlaps between trout species in Tacoma Creek, WA. Overlaps based on relative importance values for 1988.

SPECIES OVERLAPS

	Brook trout	Cutthroat trout
Brook trout	1.0	0.547
Cutthroat trout		1.0

BROOK TROUT AGE OVERLAPS

	o+	1+	2+
o+	1.o	0.638	0.241
1+		1.0	0.408
2+			1.0

CUTTHROAT TROUT AGE OVERLAPS

	0+	1+	2+
0+	1.0	0.422	0.138
1+		1.0	0.309
2+			1.0

Table 3.140. Annual diet overlaps between trout species in LeClerc Creek, WA. Overlaps based on relative importance values for 1988.

SPECIES OVERLAPS

	Brown trout	Brook trout	Cutthroat trout	Mountain whitefish
Brown trout	1 .o	0.678	0.196	0.681
Brook trout		1.0	0.272	0.657
Cutthroat trout			1 .o	0.057
Mountain whitefish				1.0

BROWN TROUT AGE OVERLAPS

	0+	1+	2+	3+	4+
0+	1.0	0.366	0.401	0.083	0.164
1+		1.0	0.540	0.484	0.574
2+			1.0	0.514	0.724
3+				1.0	0.681
4+					1.0

BROOK TROUT AGE OVERLAPS

	0+	1+	2+
0+	1.0	0.454	0.364
1+		1.0	0.156
2+			1.0

MOUNTAIN WHITEFISH AGE OVERLAPS

	3+	4+
3+	1.0	0.529
4+		1.0

moderately with the 2+ (0.514) and 4+ (0.681) age classes. The lowest overlap value was 0.083 between 0+ and 3+ brown trout.

No significant overlaps occurred between the different age classes of brook trout. Overlap values ranged from a low of 0.156 between 1+ and 2+ age classes to a high of 0.454 between 0+ and 1+ trout.

As only one age class of cutthroat trout was caught in Le Clerc Creek in 1988, no diet overlaps could be determined between the different ages.

Mountian whitefish diet overlaps were moderate (0.529) between the 3+ and 4+ age classes. No other age classes of mountain whitefish were captured.

3.6 RIVER AND SLOUGH FISH FEEDING HABITS

Results of river and slough fish feeding habits were based on mean annual values. For each age class of each species, the number percentage, weight percentage, occurrence frequency and index of relative importance for each prey item were listed. Electivity indices for zooplankton and benthic macroinvertebrates were computed for each species using percent numerical frequency values. Diet overlaps were computed using IRI values. Results of monthly feeding habits in the river and sloughs are listed in Appendix H. These data include, mean number and weight (± standard deviations), the number percentage, weight percentage, occurrence frequency and index of relative importance for each prey item for each species of fish

3.6.1 YELLOW PERCH FEEDING HABITS

During 1988, 565 yellow perch stomachs were analyzed. A total of 32 families of invertebrates in 16 orders were identified in their stomachs.

Table 3.141 lists the percent composition by number for prey items consumed by yellow perch. For 1+ yellow perch, Ostracoda had the highest numerical percentage at 31.4 percent, followed by Chydoridae at 29.0 percent and Daphnidae at 20.5 percent. Daphnidae had the highest numerical percentage at 34.4 percent for 2+ yellow perch, followed by Cyclopoida (14.2%) and Hydroptilidae (12.3%). For 3+ yellow perch, Daphnidae had the highest numerical frequency at

29.8 percent, followed by Chydoridae (24.3%) and Cyclopoida (16.9%). Chydoridae (24.9%) had the highest numerical percentage for 4+ yellow perch, followed by Daphnidae at 20.3 percent and Chironomidae pupae at 15.5 percent. For 5+ yellow perch, Baetidae had the highest numerical frequency at 25.4 percent, followed by Chydoridae at 18.4 percent and Daphnidae at 17.8 percent. Chydoridae had the highest numerical percentage at 24.4 percent for 6+ yellow perch, followed by Daphnidae (21.1%) and Baetidae (13.6%). For 7+ yellow perch, Hydracarina had the highest numerical percent at 35.1 percent followed by Gammaridae at 12.9 percent.

Table 3.142 lists the percentage by weight for prey organisms consumed by yellow perch. For 1+ yellow perch, Chydoridae had the highest weight frequency at 19.1 percent, followed by Daphnidae at 17.2 percent and Cyclopoida at 14.3 percent. Planorbidae had the highest weight frequency at 25.7 percent for 2+ yellow perch, followed by Daphnidae (18.8%) and Baetidae (15.5%). For 3+ yellow perch, Baetidae had the highest weight frequency at 33.5 percent followed by Chironomidae larvae (13.1%) and Chydoridae (10.1%). For 4+ yellow perch, Planorbidae had the highest weight frequency at 19.2 percent, followed by Libellulidae at 18.2 percent and Lestidae at 12.0 percent. Baetidae had the highest weight percentage at 24.6 percent for 5+ yellow perch, followed by Libellulidae at 13.5 percent and Planorbidae at 11 .O percent. For 6+ yellow perch, Osteichthyes had the highest weight frequency at 28.1 percent, followed by Lymnaeidae at 15.6 percent and Hydroptilidae at 11.4 percent. Coenagrionidae had the highest weight frequency for 7+ yellow perch at 36.8 percent, followed by Planorbidae (31.8%) and Sphaeriidae (27.4%).

Frequency of occurrence for prey items found in yellow perch stomachs are listed in Table 3.143. Chironomidae larvae had the highest frequency of occurrence for 1+ yellow perch at 45.4 percent, followed by Chydoridae (43.9%) and Hydroptilidae (31.8%). For 2+ yellow perch, Chironomidae larvae had the highest frequency of occurrence at 32.4 percent, followed by Daphnidae at 31.1 percent **and Chydoridae at** 29.4 **percent.** Chironomidae larvae had the highest frequency of occurrence for 3+ yellow perch at 47.1 percent, followed by Chydoridae at 46.9 percent and Daphnidae at 36.2 percent. For 4+ yellow perch, Chironomidae larvae had highest occurrence frequency at 44.3 percent followed by Chydoridae (38.0%) and Daphnidae (30.6%). Chydoridae had the highest frequency of occurrence for 5+ yellow perch at 39.0 percent, followed by Baetidae

Table 3.141. Mean annual number frequencies of prey items consumed by yellow perch for 1988, Pend Oreille River, WA.

PREY ORGANISMS	1 + N=14	2 + N=22	3 + N=141	4 + N=188	5 + N=133	6 + N=66	7 + N=1	ALL AGES N=565
TRICHOPTERA (caddisflies)								
Hydroptilidae	2.2	12.3	0.6	0.7	4.9	2.6		3.3
Limnephilidae			<0.1	0.3	<0.1			0.1
Lepidostomatidae				0.3	<0.1			0.1
Leptoceridae		0.7	0.3	0.1	0.2	0.3	1.8	0.5
Phryganeidae			<0.1	<0.1	0.1	0.1		<0.1
Hydropsychidae					<0.1			<0.1
Brachycentridae					<0.1			<0.1
EPHEMEROPTERA (mayflies)								
Baetidae	0.1	9.2	7.4	2.5	25.4	13.6		8.3
Ephemerellidae		0.2	0.1	0.2	<0.1	0.1		0.1
Tricorythidae			<0.1	0.2		<0.1		0.1
ODONATA (dragonflies, damselflies)								
Coenagrionidae	0.1		0.5	0.2	0.8	0.4	11.1	1.9
Lestidae		3.4	0.6	10.2	4.4			2.6
Libellulidae			<0.1	<0.1	0.5	0.1		0.1
COLEOPTERA (beetles)								
Elmidae		4.5	4.6	0.7	0.2	0.2		1.5
Chrysomelidae					4.4			0.6
HYDRACARINA (mites)	0.1		1.0	0.9	7.3	5.2	35.1	7.1
LEPIDOPTERA (moths)						<0.1		<0.1
DIPTERA (midges, flies)								
Chironomidae larvae	1.6	3.3	4.8	3.4	2.8	2.0	11.1	4.1
Chironomidae pupae	0.1	2.1	3.0	15.5	2.4	0.9	11.1	5.0
Tipulidae		0.5	<0.1	0.1	0.1	<0.1		0.1
Ceratopogonidae		0.2	0.4	1.0	<0.1			0.2
Muscidae				<0.1	<0.1			<0.1
Simuliidae					<0.1			<0.1
COPEPODA								
Cyclopoida	8.9	14.2	16.9	14.3	1.5	0.6		8.1
Calanoida		6.5	0.3	0.4	1.5	0.4		1.3
CLADOCERA (water fleas)								
Daphnidae	20.5	34.4	29.8	20.3	17.8	21.1	1.8	20.8
Chydoridae	29.0	2.9	24.3	24.9	18.4	24.4		17.7
AMPHIPODA (scuds)								
Talitridae	3.8		2.1	0.5	0.6	0.2		1.0
Gammaridae	0.9	0.2	0.2	0.9	2.5	0.1	12.9	2.5
OSTRACODA (seed shrimp)	31.4	2.2	1.4	0.2	0.2	0.1		5.1
GASTROPODA (snails)								
Planorbidae	1.2	3.7	0.9	1.7	2.5	2.4	11.1	3.4
Lymnaeidae	0.1		0.2	<0.1	0.2	0.2		0.1
Physidae		<0.1	<0.1	<0.1				<0.1
OSTEICHTHYES (fish)			<0.1	0.1	<0.1	8.4		1.2
Yellow perch						4.4		0.6
OLIGOCHAETA (worms)								
Lumbriculidae				0.1	0.5			0.1
NEMATODA				<0.1		0.02		<0.1
TERRESTRIAL INSECTA			0.1	0.1	0.7	0.9	1.8	0.5
BIVALVE (clams)								
Sphaeriidae							1.8	0.3
FISH EGGS			0.3			11.8		1.7

Table 3.142. Mean annual weight frequencies of prey items consumed by yellow perch for 1988, Pend Oreille River, WA.

PREY ORGANISMS	1 + N=14	2 + N=22	3 + N=141	4 + N=188	5 + N=133	6 + N=66	7 + N=1	ALL AGES N=565
TRICHOPTERA (caddisflies)								
Hydroptilidae	9.1	13.7	1.6	0.7	4.0	11.4		5.8
Limnephilidae			<0.1	0.4	<0.1			<0.1
Lepidostomatidae				<0.1	0.1			<0.1
Leptoceridae		1.5	0.2	0.3	0.3	0.8	0.3	0.9
Phryganeidae			<0.1	<0.1	0.4	1.0		0.2
Hydropsychidae					<0.1			<0.1
Brachycentridae					<0.1			<0.1
EPHEMEROPTERA (mayflies)								
Baetidae	0.4	15.5	33.5	8.4	24.6	5.5		12.6
Ephemerellidae		<0.1	0.5	0.1	0.3	<0.1		0.2
Tricorythidae			0.3	0.3		<0.1		0.1
ODONATA (dragonflies, damseflies)								
Coenagrionidae	0.8		7.3	4.5	6.4	3.3	36.8	8.4
Lestidae		4.3	2.1	12.0	1.7			2.9
Libellulidae			2.9	18.2	13.5	3.6		5.4
COLEOPTERA (beetles)								
Elmidae		0.7	2.2		0.1	0.02		0.4
Chrysomelidae					5.9			0.8
HYDRACARINA (mites)	0.4		1.1	0.8	4.2	1.2	1.2	1.3
LEPIDOPTERA (moths)						0.2		<0.1
DIPTERA (midges, flies)								
Chironomidae larvae	1.8	2.0	13.1	3.0	2.5	0.9	0.9	3.4
Chironomidae pupae	1.1	2.9	1.2	1.4	2.0	0.6	0.6	1.4
Tipulidae		0.1	0.1	0.1	0.5	<0.1		0.1
Ceratopogonidae		0.1	0.2	0.2	<0.1			0.1
Muscidae				<0.1	<0.1			<0.1
Simuliidae					<0.1			<0.1
COPEPODA								
Cyclopoida	14.3	3.9	2.6	8.7	0.1	<0.1		4.2
Calanoida		<0.1	0.1	<0.1	<0.1	0.1		<0.1
CLADOCERA (water fleas)								
Daphnidae	17.2	18.8	8.0	6.6	6.3	5.3	0.3	8.9
Chydoridae	19.1	4.5	10.1	4.2	2.7	2.2		6.1
AMPHIPODA (scuds)								
Talitridae	12.5		3.0	1.0	0.4	1.4		2.6
Gammaridae	3.6	0.2	1.8	2.1	0.7	0.1	0.3	1.5
OSTRACODA (seed shrimp)	13.6	0.7	0.7	0.2	0.4	0.1		2.2
GASTROPODA (snails)								
Planorbidae	5.8	25.7	5.1	19.2	11.0	3.3	31.8	14.6
Lymnaeidae	<0.1		1.6	3.0	5.0	15.6		3.6
Physidae		5.0	<0.1	0.9				0.8
OSTEICHTHYES (fish)			0.1	0.6	0.3	28.1		4.2
Yellow perch						10.4		1.5
OLIGOCHAETA (worms)								
Lumbriculidae				1.8	5.5			1.0
NEMATODA				<0.1		<0.1		<0.1
TERRESTRIAL INSECTA			<0.1	0.1	1.1	1.1	0.3	0.4
BIVALVE (clams)								
Sphaeriidae							27.4	3.9
FISH EGGS			0.5			3.6		1.0

at 36.9 percent and Chironomidae larvae at 35.0 percent. For 6+ yellow perch, Chironomidae larvae had the highest occurrence frequency at 32.6 percent, followed by Chydoridae (27.0%) and Planorbidae (26.3%). Hydracarina had the highest occurrence frequency at 85.7 percent for 7+ yellow perch, followed by Chironomidae larvae at 57.1 percent and Chironomidae pupae at 42.9 percent.

Index of relative importance for prey items consumed by yellow perch are listed in Table 3.144. For 1+ yellow perch, Ostracoda had the highest index of relative importance at 20.2 percent, followed by Chydoridae at 19.6 percent and Cyclopoida at 14.2 percent. Daphnidae had the highest IRI for 2+ yellow perch at 17.5 percent, followed by Planorbidae at 11.9 percent and Hydroptilidae at 11.9 percent. For 3+ yellow perch, Baetidae had the highest IRI at 14.1 percent, followed by Chydoridae (13.4%) and Chironomidae larvae (10.7%). Chydoridae had the highest IRI for 4+ yellow perch at 11.7 percent, followed by Daphnidae at 10 percent and Cyclopoida at 9.0 percent. For 5+ yellow perch, Baetidae had the highest IRI value for 5+ yellow perch at 14.5 percent followed by Chydoridae at 9.7 percent and Hydracarina at 6.8 percent. For 6+ yellow perch, Osteichthyes had the highest IRI at 11.5 percent, followed by Baetidae at 9.4 percent and yellow perch fry at 8.4 percent. Hydracarina had the highest IRI for 7+ yellow perch at 23.1 percent, followed by Coenagrionidae at 17.2 percent and Chironomidae larvae at 13.1 percent.

In general, yellow perch of all ages were consistently planktivorous, with Chydoridae and Daphnidae having the highest index of relative importance values at 9.9 percent and 9.3 percent, respectively (Table 3.144). However, yellow perch were also very opportunistic, feeding on a variety prey organisms, ranging from zooplankton to fish fry.

3.6.2 MOUNTAIN WHITEFISH FEEDING HABITS

Two hundred and eight mountain whitefish stomachs were analyzed in 1988. A total of 30 families of invertebrates in 17 orders were identified in their stomachs.

Table 3.145 lists the percent composition by number for prey items consumed by mountain whitefish. Chironomidae larvae made up 100 percent of the items consumed for 0+ mountain whitefish. For 1+ mountain whitefish, Chironomidae larvae had the highest

Table 3.143. Mean annual occurrence frequencies of prey items consumed by yellow perch for 1988, Pend Oreille River, WA.

	1 +	2 +	3 +	4 +	5 +	6 +	7 +	ALL AGES
PREY ORGANISMS	N=14	N=22	N=141	N=188	N=133	N=66	N=1	N=565
TRICHOPTERA (caddisflies)								
Hydroptilidae	31.8	25.3	22.3	21.4	25.8	12.8		19.9
Limnephilidae			0.5	3.9	1.0			0.8
Lepidostomatidae				1.9	1.0			0.8
Leptoceridae		5.6	5.1	4.2	3.8	11.3	14.3	6.3
Phryganeidae			0.5	1.0	3.1	3.2		1.1
Hydropsychidae					1.0			0.1
Brachycentridae					0.4			<0.1
EPHEMEROPTERA (mayflies)								
Baetidae	4.6	21.8	35.8	30.5	36.9	22.8		21.8
Ephemerellidae		3.0	1.8	3.4	1.0	6.6		2.2
Tricorythidae			1.0	1.0		1.3		0.5
ODONATA (dragonflies, damselflies)								
Coenagrionidae	9.1		9.9	10.1	12.4	9.2	42.8	26.3
Lestidae		9.1	10.4	9.3	22.2			7.3
Libellulidae			1.0	0.5	11.1	1.9		2.1
COLEOPTERA (beetles)								
Elmidae		9.1	1.8	5.6	1.4	3.2		3.0
Chrysomelidae					22.2			3.2
HYDRACARINA (mites)	13.6		26.1	21.5	30.9	24.7	85.7	28.9
LEPIDOPTERA (moths)						2.6		0.4
DIPTERA (midges, flies)								
Chironomidae larvae	45.4	32.4	47.1	44.3	35.0	32.6	57.1	37.7
Chironomidae pupae	9.1	17.7	26.2	26.9	25.2	24.6	42.9	24.6
Tipulidae		6.1	1.7	1.0	1.3	0.6		1.5
Ceratopogonidae		3.0	4.2	4.9	2.8			2.1
Muscidae				1.0	0.4			0.2
Simuliidae					0.4			<0.1
COPEPODA								
Cyclopoida	21.0	24.4	34.9	28.8	16.9	10.7		19.5
Calanoida		3.0	4.3	4.8	3.6	2.8		2.6
CLADOCERA (water fleas)								
Daphnidae	31.8	31.1	36.2	30.6	22.9	16.4	14.3	26.2
Chydoridae	43.9	29.4	46.9	38.0	39.0	27.0		32.0
AMPHIPODA (scuds)								
Talitridae	16.6		17.0	8.7	11.0	11.1		9.2
Gammaridae	22.7	14.1	12.2	16.6	23.8	5.4	28.6	17.6
OSTRACODA (seed shrimp)	30.3	18.9	28.9	17.5	10.9	8.1		16.4
GASTROPODA (snails)								
Planorbidae	9.1	25.0	17.5	23.0	21.8	26.3	14.3	19.6
Lymnaeidae	4.5		2.5	2.9	9.4	6.8		3.7
Physidae		5.6	0.5	1.0				1.0
OSTEICHTHYES (fish)			0.9	0.9	0.9	17.4		2.9
Yellow perch						12.5		1.8
OLIGOCHAETA (worms)								
Lumbriculidae				1.4	12.0			1.9
NEMATODA				0.5		0.7		0.2
TERRESTRIAL INSECTA			2.9	7.3	22.9	8.2	14.3	7.9
BIVALVE (clams)								
Sphaeriidae							14.3	2.0
FISH EGGS			0.9			0.7		0.2

Table 3.144. Mean annual index of relative importance (IRI) frequencies of prey items consumed by yellow perch for 1988, Pend Oreille River, WA.

	1 +	2 +	3 +	4 +	5 +	6 +	7 +	ALL AGES
PREY ORGANISMS	N=14	N=22	N=141	N=188	N=133	N=66	N=1	N=565
TRICHOPTERA (caddisflies)								
Hydroptilidae	6.2	11.9	3.5	4.0	5.4	4.9		5.1
Limnephilidae			0.1	0.8	0.2			0.2
Lepidostomatidae				0.4	0.2			0.1
Leptoceridae		1.2	0.9	0.8	0.4	2.2	3.1	1.2
Phryganeidae			0.1	0.2	0.6	0.8		0.2
Hydropsychidae					0.2			<0.1
Brachycentridae					0.1			<0.1
EPHEMEROPTERA (mayflies)								
Baetidae	0.8	9.8	14.1	7.2	14.5	9.4		8.0
Emphemerellidae		0.6	0.3	0.6	0.2	1.1		0.4
Tricorythidae			0.2	0.2		0.2		<0.1
ODONATA (dragonflies, damselflies)								
Coenagrionidae	1.4		2.9	2.6	3.4	2.4	17.2	4.3
Lestidae		3.4	2.7	5.5	4.5			2.3
Libellulidae			0.5	4.4	4.2	1.1		1.4
COLEOPTERA (beetles)								
Elmidae		2.9	1.8		0.3	0.7		0.8
Chrysomelidae					5.2			0.7
HYDRACARINA (mites)	2.1		4.7	4.0	6.8	5.9	23.1	6.6
LEPIDOPTERA (moths)						0.6		<0.1
DIPTERA (midges, flies)								
Chironomidae larvae	7.0	7.5	10.7	8.8	6.0	6.0	13.1	8.4
Chironomidae pupae	1.5	4.4	5.6	7.6	4.6	4.6	10.3	5.5
Tipulidae		1.3	0.3	0.2	0.3	0.1		0.3
Ceratopogonidae		0.6	1.4	1.1	0.9			0.6
Muscidae				0.2	0.1			<0.1
Simuliidae					0.1			<0.1
COPEPODA								
Cyclopoida	14.2	8.7	9.7	9.0	2.8	1.5		6.6
Calanoida		1.9	0.8	0.9	0.8	0.6		0.7
CLADOCERA (water fleas)								
Daphnidae	10.1	17.5	10.1	10.0	6.4	7.9	3.1	9.3
Chydoridae	19.6	7.1	13.4	11.7	9.7	8.2		9.9
AMPHIPODA (scuds)								
Talitridae	9.9		3.6	1.8	1.7	6.2		3.3
Gammaridae	4.0	2.6	2.2	3.4	4.4	1.0	7.9	3.6
OSTRACODA (seed shrimp)	20.2	4.6	4.7	3.1	1.7	1.4		5.1
GASTROPODA (snails)								
Planorbidae	2.4	11.9	3.6	7.7	5.1	5.6	10.8	6.7
Lymnaeidae	0.7		0.5	1.0	2.2	3.8		1.2
Physidae		1.9	0.1	0.3				0.3
OSTEICHTHYES (fish)			0.2	0.3	0.2	11.5		1.7
Yellow perch						8.4		1.2
OLIGOCHAETA (worms)								
Lumbriculidae				0.6	3.0			0.2
NEMATODA				0.1		0.2		<0.1
TERRESTRIAL INSECTA			0.4	1.3	3.7	1.8	3.1	1.5
BIVALVE (clams)								
Sphaeriidae							8.2	1.2
FISH EGGS			0.4			3.2		0.5

numerical frequency at 56.4 percent, followed by Chironomidae pupae at 14.2 percent and terrestrial insecta at 13.8 percent. Chironomidae larvae had the highest numerical percentage for 2+ mountain whitefish at 36.2 percent, followed by Daphnidae (29.5%) and fish eggs (15.4%). For 3+ mountain whitefish, Chironomidae larvae had the highest numerical percentage at 31.5 percent, followed by Daphnidae at 16.2 percent and Chydoridae at 15.6 percent. Chironomidae larvae had the highest numerical percentage for 4+ mountain whitefish at 43.2 percent, followed by Hydroptilidae at 16.4 percent and Chydoridae at 13.5 percent. For 5+ mountain whitefish, Chironomidae larvae had the highest numerical percentage at 53.5 percent, followed by Chydoridae at 27.5 percent and Coenagrionidae at 8.1 percent. Coenagrionidae had the highest numerical percentage for 6+ mountain whitefish at 40.9 percent, followed by Hydracarina at 27.3 percent and Planorbidae at 16.6 percent. For 7+ mountain whitefish, Chironomidae larvae and Chironomidae pupae had the highest numerical percentages at 50.0 percent each.

Weight percentages for prey items consumed by mountain whitefish are listed in Table 3.146. Chironomidae larvae made up 100 percent by weight for 0+ mountain whitefish. For 1+ mountain whitefish, Chironomidae larvae had the highest weight frequency at 33.8 percent, followed by terrestrial insecta at 20.8 percent and Chironomidae pupae at 17.9 percent. Chironomidae larvae had the highest weight frequency for 2+ mountain whitefish at 42.6 percent, followed by fish eggs (15.8%) and Leptoceridae (15.4%). For 3+ mountain whitefish, Chironomidae larvae had the highest weight frequency at 21.3 percent, followed by Coenagrionidae at 16.1 percent and Leptoceridae at 14.5 percent. Chironomidae larvae had the highest weight frequency for 4+ mountain whitefish at 54.5 percent, followed by Coenagrionidae (7.7%) and Chironomidae pupae (5.5%). For 5+ mountain whitefish, Chironomidae larvae had the highest weight percent at 34.4 percent, followed by Hydracarina at 27.6 percent and Lumbriculidae at 20.5 percent. Planorbidae had the highest weight frequency for 6+ mountain whitefish at 49.2 percent, followed by Coenagrionidae (48.5%) and Chironomidae larvae (1.3%). For 7+ mountain whitefish, Chironomidae larvae and Chironomidae pupae each had a weight percentage of 50 percent.

Frequency of occurrence for prey organisms consumed by mountain whitefish are listed in Table 3.147. Chironomidae larvae occurred in 100 percent of 0+ mountain whitefish stomachs. For 1+

Table 3.145. Mean annual number frequencies of prey items consumed by mountain whitefish for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=1	1+ N=23	2+ N=34	3+ N=81	4+ N=59	5+ N=7	6+ N=2	7+ N=1	ALL AGES N=208
TRICHOPTERA (caddisflies)									
Hydroptilidae		9.2	0.2	3.2	16.4	1.4			3.8
Limnephilidae				1.5	<0.1				0.2
Leptoceridae		<0.1	10.7	9.1	0.4	0.4			2.6
Phryganeidae		0.1		0.4	0.1				<0.1
Brachycentridae			<0.1	2.4	0.1	0.5			0.5
Rhyacophilidae			<0.1	0.1					<0.1
EPHEMEROPTERA (mayflies)									
Baetidae		0.6	4.1	0.2	<0.1	1.6			1.0
Ephemerellidae				0.1	0.7				0.1
Heptageniidae				0.1					<0.1
Tricorythidae									
ODONATA (dragonflies, damselflies)									
Coenagrionidae		0.3	0.5	5.9	2.8	8.1	40.9		7.3
Libellulidae					<0.1				<0.1
PLECOPTERA (stoneflies)									
Capnidae				<0.1					<0.1
COLEOPTERA (beetles)									
Elmidae		<0.1	<0.1	0.1	<0.1	0.1			<0.1
HYDRACARINA (mites)		0.4	0.1	0.3	0.4	0.4	27.3		3.6
LEPIDOPTERA (moths)			0.1	0.1	<0.1				<0.1
DIPTERA (flies, midges)									
Chironomidae larvae	100.0	56.4	36.2	31.5	43.2	53.5	9.8	50.0	47.6
Chironomidae pupae		14.2	2.4	8.5	7.7	4.2		50.0	10.9
Tipulidae		0.2	<0.1	0.7	0.1				0.1
Ceratopogonidae			<0.1	<0.1	<0.1				<0.1
Simuliidae		1.7	<0.1	0.2	<0.1				0.3
Empididae			<0.1	<0.1		0.1			<0.1
Amphizoidae				<0.1					<0.1
COPEPODA									
Cyclopoida		<0.1	0.1	<0.1	,0.1				<0.1
CLADOCERA (water fleas)									
Daphnidae			29.5	16.2	11.1				7.1
Chydoridae		1.0	0.1	15.6	13.5	27.5			7.2
AMPHIPODA (scuds)									
Talitridae			<0.1	0.1	<0.1				<0.1
Gammaridae		0.5	<0.1	0.5	0.1	0.1	0.8		0.3
OSTRACODA (seed shrimp)			0.2	0.1	<0.1	0.1			<0.1
GASTROPODA (snails)									
Planorbidae		0.1	0.1	0.2	0.4		16.6		2.2
Lymnaeidae		0.7	0.1	0.4	0.5	0.8			0.3
OLIGOCHAETA (worms)									
Lumbriculidae					<0.1	0.7			0.1
ANNELIDA				0.6	2.0				0.3
NEMATODA		0.4	<0.1		0.3				0.1
BIVALVE (clams)									
Sphaeriidae		<0.1		0.1	<0.1				<0.1
TERRESTRIAL INSECTA		13.8	0.2	1.5	<0.1	0.1	4.6		2.5
FISH EGGS			15.4						1.9

Table 3.146. Mean annual weight frequencies of prey items consumed by mountain whitefish for 1988, Pend Oreille River, WA.

PRFV ORGANISMS	0+ N=1	1+ N=23	2+ N=34	3+ N=81	4+ N=59	5+ N=7	6+ N=2	7+ N=1	ALL AGES N=208
TRICHOPTERA (caddisflies)									
Hydroptilidae		8.2	1.9	3.6	5.2	0.7			2.5
Limnephilidae				5.2	<0.1				0.7
Leptoceridae		0.1	15.4	14.5	0.2	3.4			4.2
Phryganeidae		0.3		3.8	2.8				0.9
Brachycentridae			0.1	0.2	0.1	1.8			0.3
Rhyacophilidae			<0.1	0.1					<0.1
EPHEMEROPTERA (mayflies)									
Baetidae		0.8	1.2	0.2	<0.1	0.2			0.3
Ephemerellidae				0.4	1.8				0.3
Heptageniidae				<0.1					<0.1
Tricorythidae									
ODONATA (dragonflies, damselflies)									
Coenagrionidae		1.3	0.4	16.1	7.7	4.0	48.5		9.8
Libellulidae					1.2				0.2
PLECOPTERA (stoneflies)									
Capnidae				<0.1					<0.1
COLEOPTERA (beetles)									
Elmidae		0.5	0.2	0.9	0.1	0.1			0.2
HYDRACARINA (mites)		1.0	0.4	0.9	0.2	27.6	0.6		3.8
LEPIDOPTERA (moths)			0.4	0.1	<0.1				<0.1
DIPTERA (flies, midges)									
Chironomidae larvae	100.0	33.8	42.6	21.3	54.5	34.4	1.3	50.0	42.2
Chironomidae pupae		17.9	2.9	13.0	5.5	2.5		50.0	11.5
Tipulidae		2.8	0.1	0.6	0.2				0.5
Ceratopogonidae			<0.1	0.1	<0.1				<0.1
Simuliidae		9.5	<0.1	0.1	<0.1				1.2
Empididae				<0.1		<0.1			<0.1
Amphizoidae				0.1					<0.1
COPEPODA									
Cyclopoida		0.1	0.3	<0.1	<0.1				<0.1
CLADOCERA (water fleas)									
Daphnidae			10.3	1.4	4.4				2.0
Chydoridae		0.2	<0.1	0.7	3.1	3.1			0.9
AMPHIPODA (scuds)									
Talitridae			<0.1	<0.1	<0.1				<0.1
Gammaridae		0.6	<0.1	0.6	<0.1	<0.1	0.1		0.2
OSTRACODA (seed shrimp)			0.1	0.1	<0.1	<0.1			<0.1
GASTROPODA (snails)									
Planorbidae		0.4	6.7	0.6	4.3		49.2		7.7
Lymnaeidae		1.4	0.1	1.7	5.3	1.7			1.3
OLIGOCHAETA (worms)									
Lumbriculidae					2.7	20.5			2.9
ANNELIDA				0.1	0.1				<0.1
NEMATODA		0.1	0.1		0.1				<0.1
BIVALVE (clams)									
Sphaeriidae		0.1		0.3	<0.1				<0.1
TERRESTRIAL INSECTA		20.8	0.5	12.4	0.3	<0.1	0.3		4.3
FISH EGGS			15.8						2.0

mountain whitefish, Chironomidae larvae had the highest occurrence frequency at 91.7 percent, followed by Chironomidae pupae (41.3%) and terrestrial insecta (25.6%). Chironomidae larvae had the highest occurrence frequency for 2+ mountain whitefish at 73.4 percent, followed by Chironomidae pupae at 50.3 percent and Cyclopoida at 16.4 percent. For 3+ mountain whitefish, Chironomidae larvae had the highest occurrence frequency at 74.6 percent followed by Chironomidae pupae (38.4%) and Coenagrionidae (29.3%). Chironomidae larvae had the highest occurrence frequency for 4+ mountain whitefish at 74.6 percent, followed by Chironomidae pupae at 41.9 percent and Hydroptilidae at 34.7 percent. For 5+ mountain whitefish, Chironomidae larvae had the highest occurrence frequency at 91.7 percent, followed by Hydroptilidae, Chironomidae pupae, and Chydoridae at 41.7 percent each. Coenagrionidae had the highest occurrence frequency for 6+ mountain whitefish, at 27.8 percent followed by Chironomidae larvae (20.6%) and Planorbidae (19.2%). For 7+ mountain whitefish, Chironomidae larvae and pupae each had an occurrence frequency of 100 percent.

Values for index of relative importance for mountain whitefish (IRI) are listed in Table 3.148. Chironomidae larvae had an IRI of 100 percent, for 0+ mountain whitefish. For 1+ mountain whitefish, Chironomidae larvae had the highest IRI at 35.6 percent, followed by Chironomidae pupae (17.1 %) and terrestrial insecta (13.3%). Chironomidae larvae had the highest IRI for 2+ mountain whitefish at 30.5 percent, followed by Daphnidae at 11.4 percent and Chironomidae pupae at 10 percent. For 3+ mountain whitefish, Chironomidae larvae had the highest IRI at 22.1 percent followed by Chironomidae pupae (10.4%) and Coenagrionidae (8.9%). Chironomidae larvae had the highest IRI for 4+ mountain whitefish at 37.0 percent, followed by Hydroptilidae at 11.8 percent and Chironomidae pupae at 9.9 percent. For 5+ mountain whitefish, Chironomidae larvae had the highest IRI at 44.3 percent, followed by Chydoridae at 10.2 percent and Hydracarina at 8.8 percent. Coenagrionidae had the highest IRI for 6+ mountain whitefish at 27.8 percent, followed by Chironomidae larvae (20.6%) and Planorbidae (19.2%). For 7t mountain whitefish, Chironomidae larvae and pupae had an IRI of 50 percent each.

Index of relative importance for all ages of mountain whitefish indicate that Chironomidae larvae (42.5%) and pupae (13.0%) are the most important prey items found in their diet (Table 3.148).

Table 3.147. Mean annual occurrence frequencies of prey items consumed by mountain whitefish for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=1	1+ N=23	2+ N=34	3+ N=81	4+ N=59	5+ N=7	6+ N=2	7+ N=1	ALL AGES N=208
TRICHOPTERA (caddisflies)									
Hydroptilidae		16.9	13.8	18.3	34.7	41.7			15.7
Limnephilidae				5.1	3.3				1.1
Leptoceridae		5.6	10.7	26.0	12.2	16.7			8.9
Phryganeidae		5.6		5.7	6.5				2.2
Brachycentridae			2.4	8.0	0.9	16.7			3.5
Rhyacophilidae			5.6	2.9					1.1
EPHEMEROPTERA (mayflies)									
Baetidae		18.2	13.1	6.7	0.9	16.7			7.0
Ephemerellidae				5.0	7.9				1.6
Heptageniidae				1.9					0.2
Tricorythidae									
ODONATA (dragonflies, damselflies)									
Coenagrionidae		11.3	8.3	29.3	18.1	16.7	27.8		13.9
Libellulidae					0.9				0.1
PLECOPTERA (stoneflies)									
Capnidae				0.9					0.1
COLEOPTERA (beetles)									
Elmidae		3.3	2.4	2.1	5.2	8.3			2.7
HYDRACARINA (mites)		20.9	14.0	27.4	28.1	33.3	13.0		17.1
LEPIDOPTERA (moths)			1.9	7.0	0.9				1.2
DIPTERA (flies, midges)									
Chironomidae larvae	100.0	91.7	73.4	74.6	74.6	91.7	20.6	100.0	78.3
Chironomidae pupa		41.3	50.3	38.4	41.9	41.7		100.0	39.2
Tipulidae		13.5	4.7	7.7	2.8				3.6
Ceratopogonidae			5.6	2.9	2.6				1.4
Simuliidae		13.5	4.8	0.9	0.9				2.5
Empididae			5.6	5.1		8.3			2.4
Amphizoidae				3.1					0.4
COPEPODA									
Cyclopoida		2.4	16.4		4.1				2.9
CLADOCERA (water fleas)									
Daphnidae			13.9	8.9	11.6				4.3
Chydoridae		18.5	11.9	5.0	19.2	41.7			12.0
AMPHIPODA (scuds)									
Talitridae			1.9	3.9	5.7				1.4
Gammaridae		3.3	1.9	16.8	8.8	8.3	10.2		6.2
OSTRACODA (seed shrimp)			2.4	6.7	7.4	8.3			3.1
GASTROPODA (snails)									
Planorbidae		1.7	10.2	15.7	7.0		19.2		6.7
Lymnaeidae		5.0	5.6	7.1	8.5	16.7			5.4
OLIGOCHAETA (worms)									
Lumbriculidae					1.8	8.3			1.3
ANNELIDA				0.9	3.7				0.6
NEMATODA		11.1	0.1		3.7				1.9
BIVALVE (clams)									
Sphaeriidae		2.4		6.1	1.9				1.3
TERRESTRIAL INSECTA		25.6	0.5	20.1	5.0	8.3	9.2		8.6
FISH EGGS			15.8						2.0

Table 3.148. Mean annual index of relative importance **(IRI)** frequencies of prey items consumed by mountain whitefish for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=1	1+ N=23	2+ N=34	3+ N=81	4+ N=59	5+ N=7	6+ N=2	7+ N=1	ALL AGES N=208
TRICHOPTERA (caddisflies)									
Hydroptilidae		5.8	4.7	4.4	11.6	6.2			4.1
Limnephilidae				2.0	0.6				0.3
Leptoceridae		0.8	8.2	8.6	2.0	2.7			2.8
Phryganeidae		0.9		1.7	1.4				0.5
Brachycentridae			0.4	1.8	0.2	2.5			0.6
Rhyacophilidae			0.9	0.5					0.2
EPHEMEROPTERA (mayflies)									
Baetidae		3.3	3.9	1.2	0.1	2.5			1.4
Ephemerellidae				0.9	2.0				0.4
Heptageniidae				0.4					<0.1
ODONATA (dragonflies, damselflies)									
Coenagrionidae		2.2	2.1	8.9	4.3	3.8	27.8		6.1
Libellulidae					0.3				<0.1
PLECOPTERA (stoneflies)									
Capnidae				0.2					<0.1
COLEOPTERA (beetles)									
Elmidae		0.8	0.5	0.5	0.8	1.1			0.5
HYDRACARINA (mites)		3.8	2.9	5.0	4.5	8.8	13.0		4.8
LEPIDOPTERA (moths)		0.5	1.2	0.1					0.2
DIPTERA (flies, midges)									
Chironomidae larvae	100.0	35.6	30.5	22.1	37.0	44.3	20.6	50.0	42.5
Chironomidae pupa		17.1	10.0	10.4	9.9	6.8		50.0	13.0
Tipulidae		2.5	0.4	1.6	0.5				0.6
Ceratopogonidae			0.9	0.5	0.4				0.2
Simuliidae		4.1	0.9	0.9	0.1				0.8
Empididae			0.9	0.3		1.1			0.3
Amphizoidae				0.2					<0.1
COPEPODA									
Cyclopoida		0.5	3.0	0.6	0.7				0.6
CLADOCERA (water fleas)									
Daphnidae			11.4	4.6	5.9				2.7
Chydoridae		3.3	2.2	3.7	6.1	10.2			3.2
AMPHIPODA (scuds)									
Talitridae			0.4	0.7	1.0				0.3
Gammaridae		0.9	0.4	3.1	1.4	1.1	10.3		2.1
OSTRACODA (seed shrimp)			0.5	1.2	1.1	1.1			0.5
GASTROPODA (snails)									
Planorbidae		0.9	3.5	2.9	1.9		19.2		3.6
Lymnaeidae		1.5	1.2	1.6	2.4	2.6			1.2
OLIGOCHAETA (worms)									
Lumbriculidae					0.7	3.9			0.6
ANNELIDA				0.3	0.9				0.2
NEMATODA		1.7	0.9		0.6				0.4
BIVALVE (clams)									
Sphaeriidae		0.5	5.8	1.1	0.3				1.0
TERRESTRIAL INSECTA		13.3	3.1	5.9	0.9	1.1	9.2		4.2
FISH EGGS			5.8						0.7

3.6.3 LARGEMOUTH BASS FEEDING HABITS

In 1988, 321 largemouth bass stomachs ranging from 0+ to 13+ years old were analyzed to assess feeding habits.

Table 3.149 lists the number frequencies of prey organisms consumed by largemouth bass. Daphnidae had the highest numerical percentage for 0+ largemouth bass at 60.7 percent, followed by Chydoridae at 16.5 percent and Baetidae at 12.4 percent. For 1+ largemouth bass, Daphnidae had the highest numerical percentage at 43.4 percent followed by Chydoridae (42.0%) and Baetidae (4.9%). Chydoridae had the highest numerical frequency for 2+ largemouth bass at 44.7 percent followed by Baetidae at 29.7 percent and Coenagrionidae at 8.0 percent. For 3+ largemouth bass, Baetidae had the highest numerical percentage at 37.2 percent, followed by Chydoridae at 31.3 percent and Daphnidae at 9.2 percent.

Numerical percentages of prey organisms consumed by 4+ and older largemouth bass were predominated by fish (Osteichthyes) (Table 3.149). Osteichthyes made up a low of 45.8 percent by number in 4+ largemouth and a high of 100 percent by number in 8+ and 13+ largemouth. Of fish that could be identified in largemouth bass stomachs, yellow perch were by far the most abundant, comprising a high of 66.7 percent by number in 9+ largemouth bass. Pumpkinseed comprised a high of 33.3 percent by number in 6+ largemouth bass.

Table 3.150 lists the weight percentages of prey organisms found in largemouth bass diets. Baetidae had the highest weight percentage for 0+ largemouth bass at 74.4 percent, followed by Cyclopoida at 8.7 percent and Daphnidae at 7.6 percent. For 1+ largemouth bass, Osteichthyes had the highest weight percentage at 37.2 percent, followed by Chydoridae (27.5%) and Baetidae (15.0%). Baetidae had the highest weight frequency for 2+ largemouth bass at 38.1 percent, followed by Coenagrionidae at 14.5 percent and Osteichthyes at 11.5 percent. For 3+ largemouth bass, Osteichthyes had the highest weight percentage at 69.3 percent, followed by terrestrial insecta (6.0%) and Baetidae (5.9%). The weight percentages of 4+ and older largemouth bass were dominated by Osteichthyes, ranging from a low of 50 percent in 7+ largemouth bass to a high of 100 percent in 8+ and 13+ largemouth bass.

Occurrence frequency for prey items consumed by largemouth bass are listed in Table 3.151. Baetidae had the highest occurrence

Table 3.149. Mean annual number frequencies of prey items consumed by largemouth bass for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=17	1+ N=70	2+ N=57	3+ N=119	4+ N=23	5+ N=13	6+ N=8	7+ N=4	8+ N=1	9+ N=5	10+ N=2	12+ N=1	13+ N=1	ALL AGES N=321
TRICHOPTERA (caddisflies)														
Hydroptilidae			0.1		0.4									<0.1
EPHEMEROPTERA (mayflies)														
Baetidae	12.4	4.9	29.7	37.2	17.4	10.0								8.6
Ephemerellidae			<0.1	<0.1										<0.1
Tricorythidae	0.3			<0.1										<0.1
ODONATA (dragonflies, damselflies)														
Coenagrionidae		0.4	8.0	4.8	18.2	1.9								2.6
Libellulidae		0.8	<0.1	2.3	1.1									0.3
HYDRACARINA (mites)	0.1	0.4	1.9	0.1	0.4			1.6		8.3				1.0
DIPTERA (flies, midges)														
Chironomidae larvae	5.2	1.6	1.0	1.9	1.0			41.8						3.3
Chironomidae pupae	1.7	1.0	1.2	2.4	1.8		0.2					33.4		3.2
Ceratopogonidae				0.3				0.1						<0.1
Muscidae		0.1												<0.1
Simuliidae				<0.1										<0.1
COPEPODA														
Cyclopoida	1.3	0.5	1.0	<0.1										0.2
Calanoida		0.1	0.7	<0.1										0.1
CLADOCERA (water fleas)														
Daphnidae	60.7	43.4	5.3	9.2	.									9.1
Chydoridae	16.5	42.0	44.7	31.3	0.9			0.5						10.4
AMPHIPODA (scuds)														
Talitridae	1.1	0.7	3.2	2.3										0.6
Gammaridae		1.7	0.2	0.5	0.4									0.2
OSTRACODA (seed shrimp)	0.1	0.2	0.2											<0.1
GASTROPODA (snails)														
Planorbidae								4.1						0.3
Lymnaeidae								0.8						<0.1
OSTEICHTHYES (fish)		0.5	0.3	1.9	45.8	40.7	11.1		100.0	16.7	50.0	66.7	100.0	33.4
Yellow perch					0.2	36.7	22.9	50.0		66.7	50.0			17.2
Pumpkinseed						3.3	33.3							2.8
FROG							16.7							1.3
TERRESTRIAL INSECTA	0.8	1.4	2.6	4.7	12.5	5.6	16.0	0.4						3.4
HEMIPTERA (bugs)														
Corixidae		0.2		0.1	0.7									0.1
Gerridae			<0.1	<0.1										<0.1
BIVALVE (clams)														
Sphaeriidae								0.1		8.3				0.6
CESTODA (tapeworms)						1.8								0.1
FISH EGGS			.	0.3	0.4									0.1

Table 3.150. Mean annual weight frequencies, of prey Items consumed by largemouth bass for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=17	1+ N=70	2+ N=57	3+ N=119	4+ N=23	5+ N=13	6+ N=8	7+ N=4	8+ N=1	9+ N=5	10+ N=2	12+ N=1	13+ N=1	ALL AGES N=321
TRICHOPTERA (caddisflies)														
Hydroptilidae				0.3		<0.1								<0.1
EPHEMEROPTERA (mayflies)														
Baetidae	74.4	15.0	38.1	5.9	1.6	0.1								10.4
Ephemerellidae			0.5	<0.1										<0.1
Tricorythidae	0.3			<0.1										<0.1
ODONATA (dragonflies, damselflies)														
Coenagrionidae		2.0	14.5	5.3	1.1	0.1								1.8
Libellulidae		4.0	6.7	5.4	2.9									1.5
HYDRACARINA (mites)	0.3	0.5	0.6	0.1	<0.1			0.2		0.1				<0.1
DIPTERA (flies, midges)														
Chironomidae larvae	0.9	1.5	1.0	0.4	<0.1			21.6				0.1		2.0
Chironomidae pupae	2.9	2.2	2.2	1.0	<0.1			0.2						0.7
Ceratopogonidae				0.3				0.2						<0.1
Muscidae		<0.1												<0.1
Simuliidae				<0.1										<0.1
COPEPODA														
Cyclopoida	8.7	0.6	2.8	<0.1										0.9
Calanoida		0.1	0.1	<0.1										<0.1
CLADOCERA (water fleas)														
Daphnidae	7.6	2.9	0.8	0.3										0.9
Chydoridae	3.1	27.5	9.6	1.0	<0.1			0.2						3.2
AMPHIPODA (scuds)														
Talitridae	1.6	0.8	2.4	0.3										0.4
Gammaridae		0.5	1.6	2.1	<0.1									0.3
OSTRACODA (seed shrimp)	0.3	0.1	0.3											<0.1
GASTROPODA (snails)														
Planorbidae								23.6						1.8
Lymnaeidae								3.4						0.3
OSTEICHTHYES (fish)		37.2	11.5	69.3	78.7	43.7	11.1		100.0	16.7	50.0	99.9	100.0	47.5
Yellow perch					15.2	43.3	48.4	50.0		83.2	50.0			22.3
Pumpkinseed						12.7	33.3							3.5
FROG							7.1							0.5
TERRESTRIAL INSECTA	0.3	6.7	6.9	6.0	0.4	0.1	0.1	0.5						1.6
HEMIPTERA (bugs)														
Corixidae		0.8		<0.1	0.1									<0.1
Gerridae			0.4	1.6										0.2
BIVALVE (clams)														
Sphaeriidae								0.2		0.1				<0.1
CESTODA (tapeworms)						<0.1								<0.1
FISH EGGS				<0.1	<0.1									<0.1

frequency for 0+ largemouth bass at 68.9 percent, followed by Chydoridae at 51.6 percent and Daphnidae at 39.4 percent. For 1+ largemouth bass, Chydoridae had the highest frequency of occurrence at 55.9 percent, followed by Baetidae at 37.2 percent, and Chironomidae larvae at 28.7 percent. Baetidae had the highest occurrence frequency for 2+ largemouth bass at 50.0 percent, followed by Talitridae at 41.7 percent and Coenagrionidae at 37.5 percent. For 3+ largemouth bass, Baetidae had the highest occurrence frequency at 29.6 percent followed by Terrestrial insecta (21.8%) and Osteichthyes (20.5%). In largemouth bass 4+ and older, Osteichthyes had the highest frequency of occurrence ranging from 50.0 percent to 100 percent.

Table 3.152 lists the index of relative importance for prey items consumed by largemouth bass. Baetidae had the highest IRI for 0+ largemouth bass at 34.5 percent, followed by Daphnidae at 23.9 percent and Chydoridae at 15.8 percent. For 1+ largemouth bass, Chydoridae had the highest IRI at 28.9 percent, followed by Daphnidae (16.6%) and Baetidae (13.2%). Baetidae had the highest IRI for 2+ largemouth bass at 25.1 percent, followed by Chydoridae at 16.3 percent and Coenagrionidae at 12.8 percent. For 3+ largemouth bass, Osteichthyes had the highest IRI at 23.7 percent, followed by Baetidae (18.8%) and Chydoridae (11 .O%). Index of relative importance for largemouth bass 4 years and older were highest for Osteichthyes, ranging from a low of 11 .1 percent to a high of 100 percent. Yellow perch were by far the most common fish identified in largemouth bass stomachs, with IRI ranging from 5.6 percent to 70.0 percent.

In general, young largemouth bass are highly planktivorous, with a diet consisting of zooplankton, and other small invertebrates, predominantly mayflies (Baetidae). At age 3+ and 4+, fish become the major prey item for largemouth bass, and remained important in their diet throughout the rest of their lives. Yellow perch are by far the most important fish species found in largemouth bass diets.

3.6.4 BLACK CRAPPIE FEEDING HABITS

During 1988, 103 black crappie stomachs were analyzed. A total of 20 families of invertebrates in 9 orders were identified in black crappie stomachs.

Percent composition by number for prey organisms consumed by black crappie are listed in Table 3.153. Daphnidae made up 100

Table 3.151. Mean annual occurrence frequencies of prey items consumed by largemouth bass for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=17	1+ N=70	2+ N=57	3+ N=119	4+ N=23	5+ N=13	6+ N=8	7+ N=4	8+ N=1	9+ N=5	10+ N=2	12+ N=1	13+ N=1	ALL AGES N=321
TRICHOPTERA (caddisflies)														
Hydroptilidae			2.8		1.8									0.4
EPHEMEROPTERA (mayflies)														
Baetidae	68.9	37.2	50.0	29.6	19.7	16.7								17.1
Ephemerellidae			1.1	0.6										0.1
Tricorythidae	9.1			0.6										0.7
ODONATA (dragonfiles, damselflies)														
Coenagrionidae		2.1	37.5	17.7	22.2	5.6								6.5
Libellulidae		8.3	1.1	8.7	3.7									1.7
HYDRACARINA (mites)	9.1	5.2	8.9	2.4	1.8			33.3	25.0					6.6
DIPTERA (flies, midges)														
Chironomidae larvae	27.3	29.7	20.1	19.2	6.0			50.0						11.6
Chironomidae pupae	13.7	13.9	15.3	18.2	6.6			33.3				100.0		15.5
Ceratopogonidae				1.7				33.3						2.7
Muscidae		0.9												<0.1
Simuliidae				0.7										<0.1
COPEPODA														
Cyclopoida	4.7	11.5	11.5	2.2										2.3
Calanoida		2.6	3.0	0.7										0.5
CLADOCERA (water fleas)														
Daphnidae	39.4	25.6	18.2	13.1										7.4
Chydoridae	51.6	55.9	22.0	10.4	6.6			50.0						15.1
AMPHIPODA (scuds)														
Talitridae	17.4	8.7	41.7	8.3										5.9
Gammaridae		9.2	6.4	5.7	1.8									1.8
OSTRACODA (seed shrimp)	4.6	3.8	4.5											1.0
GASTROPODA (snails)														
Planorbidae								33.3						2.6
Lymnaeidae								33.3						2.6
OSTEICHTHYES (fish)		12.4	5.6	20.5	70.4	58.3	11.1		100.0	25.0	50.0	100.0	100.0	42.6
Yellow perch					2.4	41.7	30.6	50.0		100.0	50.0			21.1
Pumpkinseed						8.3	33.3							3.2
FROG							16.7							1.3
TERRESTRIAL INSECTA	4.6	3.9	18.9	21.8	13.9	5.6	8.3	16.7						7.2
HEMIPTERA (bugs)														
Corixidae		2.1		1.2	4.2									0.6
Gerridae			0.2	0.6										<0.1
BIVALVE (clams)														
Sphaeriidae								33.3		25.0				4.5
CESTDDA (tape worms)						5.6								9.4
FISH EGGS				0.7	1.6									0.2

Table 3.152. Mean annual index of relative importance (IRI) frequencies of prey items consumed by largemouth bass for 1988, Pend Oreille River.

PREY ORGANISMS	0+ N=17	1+ N=70	2+ N=57	3+ N=119	4+ N=23	5+ N=13	6+ N=8	7+ N=4	8+ N=1	9+ N=5	10+ N=2	12+ N=1	13+ N=1	ALL AGES N=321
TRICHOPTERA (caddisflies)														
Hydroptilidae			0.7		0.6									0.1
EPHEMEROPTERA (mayflies)														
Baetidae	34.5	13.2	25.1	18.8	11.2	7.6								8.5
Ephemerellidae			0.3	0.2										0.3
Tricorythidae	2.2			0.2										0.2
ODONATA (dragonflies, damselflies)														
Coenagrionidae		1.0	12.8	7.2	11.5	1.9								2.6
Libellulidae		3.0	1.7	4.2	2.0									0.8
HYDRACARINA (mites)	2.1	1.3	2.4	0.7	0.6			3.4		6.7				1.3
DIPTERA (flies, midges)														
Chironomidae larvae	7.4	7.3	4.7	5.6	1.6			16.2						3.3
Chironomidae pupae	4.1	3.9	4.0	5.6	1.8			3.4				33.3		4.3
Ceratopogonidae				0.6				3.4						0.3
Muscidae		0.2												<0.1
Simuliidae				0.2										<0.1
COPEPODA														
Cyclopoida	3.3	2.9	3.3	0.6										0.8
Calanoida		0.6	0.8	0.2										0.1
CLADOCERA (water fleas)														
Daphnidae	23.9	16.6	5.2	5.8										4.0
Chydoridae	15.8	28.9	16.3	11.0	2.3			6.8						6.2
AMPHIPODA (scuds)														
Talitridae	4.5	2.3	10.1	2.8	0.6									1.6
Gammaridae		2.6	1.7	2.1										0.5
OSTRACODA (seed shrimp)	1.1	0.9	1.1											0.2
GASTROPODA (snails)														
Planorbidae								6.1						0.5
Lymnaeidae								3.7						0.3
OSTEICHTHYES (fish)		11.6	3.7	23.7	54.7	41.1	11.1		100.0	16.7	50.0	66.7	100.0	36.9
Yellow perch					5.6	38.7	34.0	50.0		70.0	50.0			19.1
Pumpkinseed						6.1	33.3							3.0
FROG							13.5							1.0
TERRESTRIAL INSECTA	1.3	2.8	6.1	8.4	6.0	2.8	8.1	3.5						3.0
HEMIPTERA (bugs)														
Corixidae		0.7		0.3	1.0									0.2
Gerridae			0.1	0.6										<0.1
BIVALVE (clams)														
Sphaeriidae								~~3.4~~		~~6.7~~				0.8
CESTODA (tapeworms)						1.8								0.1
FISH EGGS				0.3	0.6									<0.1

percent by number for 0+ black crappie. For 1+ black crappie, Cyclopoida had the highest numerical frequency at 34.4 percent followed by Daphnidae (30.2%) and Calanoida (20.8%). Cyclopoida had the highest numerical percent for 3+ black crappie at 35.5 percent, followed by Daphnidae at 34 percent and Chydoridae at 25.5 percent. Chydoridae had the highest numerical percent for 4+ black crappie at 35.2 percent, followed by Daphnidae (28.3%) and Chironomidae pupae (16.8%). For 5+ black crappie, Chydoridae had the highest numerical frequency at 31.9 percent, followed by Baetidae at 16.9 percent and Daphnidae at 13.6 percent. Daphnidae had the highest numerical percentage for 6+ black crappie at 41.6 percent, followed by Baetidae (21.5%) and Chironomidae larvae (19.8%). For 7+ black crappie, Tricorythidae had the highest numerical percent (70.3) followed by Daphnidae (24.8%), Cyclopoida (2.2%) and Coenagrionidae (2.2%).

Table 3.154 lists percent by weight for prey items consumed by black crappie. Daphnidae made up 100 percent by weight for 0+ black crappie. For 1+ black crappie, Calanoida had the highest weight percentage at 39.0 percent, followed by Daphnidae (25.4%), and Chironomidae larvae and Cyclopoid at 7.2 percent each. Cyclopoida had the highest weight percentage for 3+ black crappie at 23.3 percent, followed by Daphnidae at 20.0 percent and Chydoridae at 16.2 percent. For 4+ black crappie, Chydoridae had the highest weight frequency at 27.1 percent, followed by Chironomidae pupae (18.5%) and Osteichthyes (12.4%). Baetidae had the highest weight frequency for 5+ black crappie at 21.3 percent, followed by Coenagrionidae at 14.2 percent and Osteichthyes at 13.7 percent. For 6+ black crappie, Coenagrionidae had the highest weight frequency at 61.3 percent, followed by Chironomidae larvae (14.6%) and Baetidae (8.5%). Tricorythidae had the highest weight frequency for 7+ black crappie at 53.0 percent, followed by Coenagrionidae at 30.3 percent and Daphnidae at 8.3 percent.

Frequency of occurrence for prey items consumed by black crappie are listed in Table 3.155. Daphnidae occurred in 100 percent of 0+ black crappie stomachs. For 1+ black crappie, Daphnidae and Calanoida had the highest frequency of occurrence at 100 percent. Chydoridae had the highest frequency of occurrence for 3+ black crappie at 72.1 percent, followed by Cyclopoida (59.3%) and Chironomidae pupae (50.6%). For 4+ black crappie, Chydoridae had the highest frequency of occurrence at 56.1 percent, followed by Chironomidae pupae at 52.8 percent and Chironomidae larvae at 43.3

Table 3.153. Mean annual number frequencies of prey items consumed by black crappie for 1988, Pend Oreille River, WA.

	0 +	1 +	3 +	4 +	5 +	6 +	7 +	ALL AGES
PREY ORGANISMS	N=1	N=2	N=47	N=26	N=24	N=1	N=2	N=103
TRICHOPTERA (caddisflies)								
Hydroptilidae			0.1	<0.1	0.1			<0.1
Leptoceridae			<0.1	<0.1				<0.1
Phryganeidae							0.4	<0.1
EPHEMEROPTERA (mayflies)								
Baetidae			0.5	4.7	16.9	21.5		6.2
Emphemerellidae			<0.1	<0.1	0.1			<0.1
Tricorythidae			<0.1				70.3	10.1
ODONATA (dragonflies, damselflies)								
Coenagrionidae			<0.1	<0.1	2.1	9.1	2.2	1.9
HYDRACARINA (water mites)			<0.1	<0.1	0.2			<0.1
DIPTERA (midges, flies)								
Chironomidae larvae		2.7	1.0	0.7	12.1	19.8		5.2
Chironomidae pupae			0.8	16.8	13.2	1.4		4.6
Ceratopogonidae			<0.1	<0.1				<0.1
Muscidae					<0.1			<0.1
Culicidae					0.4			<0.1
COPEPODA								
Cyclopoida		34.4	35.5	12.2	3.0		2.2	12.5
Calanoida		20.8	<0.1	0.9				3.1
CLADOCERA (water fleas)								
Daphnidae	100.0	30.2	34.0	28.3	13.6	41.6	24.8	38.9
Chydoridae		3.7	25.5	35.2	31.9			13.8
Sididae			<0.1					<0.1
Leptadoridae				0.3				<0.1
AMPHIPODA (scuds)								
Talitridae			1.1	<0.1	2.0			0.5
Gammaridae		0.2	<0.1	0.2	0.4	6.2		1.0
OSTRACODA (seed shrimp)		8.1	0.2	<0.1	0.2	0.3		1.3
OSTEICHTHYES (fish)				<0.1	2.7			0.4
TERRESTRIAL INSECTA				0.4	1.6			0.3

Table 3.154. **Mean annual weight frequencies of prey items consumed by black crappie for 1988, Pend Oreille, WA.**

	0 +	1 +	3 +	4 +	5 +	6 +	7 +	ALL AGES
PREY ORGANISMS	N=1	N=2	N=47	N=26	N=24	N=1	N=2	N=103
TRICHOPTERA (caddisflies)								
Hydroptilidae			0.3	0.2	<0.1			<0.1
Leptoceridae			<0.1	0.2				<0.1
Phryganeidae							7.6	1.1
EPHEMEROPTERA (mayflies)								
Baetidae			2.2	5.3	21.3	8.5		5.3
Emphemerellidae			0.9	<0.1	<0.1			0.2
Tricorythidae			1.2				53.0	7.7
ODONATA (dragonflies, damselflies)								
Coenagrionidae			0.1	1.8	14.2	61.3	30.3	15.4
HYDRACARINA (water mites)			0.1	<0.1	0.3			<0.1
DIPTERA (midges, flies)								
Chironomidae larvae		7.2	10.3	5.0	12.4	14.6		7.1
Chironomidae pupae			4.6	16.5	6.4	0.9		4.3
Ceratopogonidae			0.4	<0.1				<0.1
Muscidae					<0.1			<0.1
Culicidae					0.8			0.1
COPEPODA								
Cyclopoida		7.2	23.3	10.8	1.2		0.8	6.2
Calanoida		39.0	0.2	0.2				5.6
CLADOCERA (water fleas)								
Daphnidae	100.0	25.4	20.0	11.2	12.0	4.9	8.3	26.5
Chydoridae		7.2	16.2	27.1	10.6			8.7
Sididae			4.6					0.7
Leptadoridae				0.7				0.1
AMPHIPODA (scuds)								
Talitridae			4.3	0.3	0.3			0.7
Gammaridae		7.2	1.0	2.3	2.1	7.6		2.9
OSTRACODA (seed shrimp)		7.2	0.8	<0.1	0.2	1.8		1.4
OSTEICHTHYES (fish)				12.4	13.7			3.7
TERRESTRIAL INSECTA				4.1	4.6			1.2

percent. Chironomidae pupae had the highest occurrence frequency for 5+ black crappie at 67.6 percent, followed by Chironomidae larvae (60.7%) and Baetidae (58.3%). For 6+ black crappie only a single fish stomach was analyzed so frequency of occurrence was 100 percent for all prey encountered. Phryganeidae, Tricorythidae, Coenagrionidae, Cyclopoida and Daphnidae each had a frequency of occurrence of 50 percent in 7+ black crappie stomachs.

Index of relative importance values for prey items consumed by black crappie are listed in Table 3.156. Daphnidae made up 100 percent in IRI for 0+ black crappie. For 1+ black crappie, Calanoida had the highest IRI at 31.9 percent followed by Daphnidae at 30.9 percent and Cyclopoida at 10.2 percent. Cyclopoida had the highest IRI for 3+ black crappie at 19.2 percent, followed by Chydoridae (18.5%) and Daphnidae (15.1 %). For 4+ black crappie, Chydoridae had the highest IRI at 23.6 percent, followed by Chironomidae pupae at 17.6 percent and Daphnidae at 14.1 percent. Baetidae had the highest IRI for 5+ black crappie at 15.6 percent, followed by Chironomidae pupae at 14.1 percent and Chironomidae larvae at 13.8 percent. For 6+ black crappie, Coenagrionidae had the highest IRI at 18.9 percent followed by Daphnidae (16.3%) and Chironomidae larvae (14.9%). Tricorythidae had the highest IRI for 7+ black crappie at 38.5 percent, followed by Daphnidae at 18.5 percent and Coenagrionidae at 18.3 percent.

Overall, black crappie are very planktivorous with Daphnidae making up 28.8 percent in IRI for all age classes combined (Table 3.156). The younger age classes seem to rely almost exclusively on zooplankton, as black crappie grow older they feed more heavily on benthic macroinvertebrates such as mayflies, damselflies, and chironomids.

3.6.5 PUMPKINSEED FEEDING HABITS

In 1988, 53 pumpkinseed stomachs were analyzed. Twenty-five families of invertebrates were identified in pumpkinseed stomachs.

Table 3.157 lists percent composition by number for prey items consumed by pumpkinseed. Ostracoda had the highest numerical percentage for 0+ pumpkinseed at 48.9 percent, followed by Chironomidae larvae at 32.2 percent and Planorbidae at 10.0 percent. For 2+ pumpkinseed, Chironomidae larvae had the highest numerical percent at 58.3 percent, followed by Elmidae (12.2%) and

Table 3.155. Mean annual occurrence frequencies of prey items consumed by black crappie for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0 + N=1	1 + N=2	3 + N=47	4 + N=26	5 + N=24	6 + N=1	7 + N=2	ALL AGES N=103
TRICHOPTERA (caddisflies)								
Hydroptilidae			9.5	5.6	3.7			2.7
Leptoceridae			3.7	1.7				0.8
Phryganeidae							50.0	7.1
EPHEMEROPTERA (mayflies)								
Baetidae			34.0	11.1	58.3	100.0		29.1
Emphemerellidae			1.5	1.7	3.7			1.0
Tricorythidae			2.7				50.0	7.5
ODONATA (dragonflies, damselflies)								
Coenagrionidae			2.4	4.5	16.1	100.0	50.0	25.0
HYDRACARINA (water mites)			8.7	12.6	6.3			4.3
DIPTERA (midges, flies)								
Chironomidae larvae		50.0	43.8	43.3	60.7	100.0		42.5
Chironomidae pupae			50.6	52.8	67.6	100.0		38.7
Ceratopogonidae			3.0	1.7				0.7
Muscidae					1.9			0.3
Culicidae					6.3			1.2
COPEPODA								
Cyclopoida		50.0	59.3	28.3	52.6		50.0	34.3
Calanoida		100.0	2.4	13.8				16.6
CLADOCERA (water fleas)								
Daphnidae	100.0	100.0	30.8	31.1	16.7	100.0	50.0	62.4
Chydoridae		50.0	72.1	56.1	40.3			32.2
Sididae			2.4					0.3
Leptadoridae				5.6				0.8
AMPHIPODA (scuds)								
Talitridae			24.1	5.6	4.2			4.6
Gammaridae		50.0	6.3	7.2	16.7	100.0		26.0
OSTRACODA (seed shrimp)		50.0	30.7	12.6	20.4	100.0		31.7
OSTEICHTHYES (fish)			6.1	5.5	10.2			3.4
TERRESTRIAL INSECTA			2.8	[illegible]	25.9			5.5

Table 3.156. Mean annual index of relative importance (IRI) frequencies of prey items consumed by black crappie for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0+ N=1	1+ N=2	3+ N=47	4+ N=26	5+ N=24	6+ N=1	7+ N-2	ALL AGES N=103
TRICHOPTERA (caddisflies)								
Hydroptilidae			1.6	1.2	0.6			0.5
~~Leptoceridae~~			~~0.6~~	~~0.4~~				~~0.1~~
Phryganeidae							12.9	1.0
EPHEMEROPTERA (mayflies)								
Baetidae			6.0	4.2	15.6	14.5		5.8
Emphemerellidae			0.9	0.3	0.6			0.3
Tricorythidae			0.6				36.5	5.6
ODONATA (dragonflies, damselflies)								
Coenagrionidae			0.4	1.3	5.6	18.9	18.3	6.4
HYDRACARINA (water mites)			1.4	0.6	1.4			0.5
DIPTERA (midges, flies)								
Chironomidae larvae		6.6	8.9	9.8	13.8	14.9		7.7
Chironomidae pupae			9.1	17.6	14.1	11.9		7.5
Ceratopogonidae			0.6	0.3				0.1
Muscidae					0.3			<0.1
Culicidae					1.5			0.2
COPEPODA								
Cyclopoida		10.2	19.2	10.2	9.2		11.8	8.7
Calanoida		31.9	0.4	3.0				5.0
CLADOCERA (water fleas)								
Daphnidae	100.0	30.9	15.1	14.1	6.8	16.3	18.5	28.8
Chydoridae		6.8	16.5	23.6	13.4			8.9
Sididae			1.2					<0.1
Lepladoridae				1.3				<0.2
AMPHIPODA (scuds)								
Talitridae			4.8	1.2	1.1			1.0
Gammaridae		6.4	1.5	1.9	3.1	12.7		3.7
OSTRACODA (seed shrimp)		7.2	6.4	2.6	3.4	11.4		4.4
OSTEICHTHYES (fish)				2.9	4.3			1.0
TERRESTRIAL HSECTA				3.6	5.2			1.3

Daphnidae (11.4%). Chironomidae larvae, had the highest number percent for 3+ pumpkinseed at 62.4 percent, followed by Planorbidae at 10.7 percent and Hydracarina at 6.9 percent. For 4+ pumpkinseed, Chironomidae larvae had the highest numerical percentage at 42.6 percent, followed by Planorbidae (11.7%) and Elmidae (9.1%). Chironomidae larvae had the highest numerical percent for 5+ pumpkinseed, at 66.4 percent, followed by Elmidae at 15.5 percent and Planorbidae at 4.7 percent. For 6+ pumpkinseed, Chydoridae had the highest numerical percentage at 50.0 percent, followed by Hydroptilidae at 25.0 percent and Chironomidae larvae at 17.9 percent.

Percent composition by weight for items consumed by pumpkinseed are listed in Table 3.158. For 0+ pumpkinseed, Tricorythidae, Chironomidae larvae, Daphnidae, Ostracoda, and Planorbidae each had a weight percentage of 20 percent. Chironomidae larvae had the highest weight frequency for 2+ pumpkinseed at 37.7 percent, followed by terrestrial insecta (18.8%) and Lumbriculidae (12.6%). For 3+ pumpkinseed, Lumbriculidae had the highest weight frequency at 42.2 percent followed by Chironomidae larvae at 16.6 percent and Hydroptilidae at 16.2 percent. Chironomidae larvae had the highest weight percentage at 29.6 percent for 4+ pumpkinseed, followed by Planorbidae (21.9%) and Lymnaeidae (19.5%). In 5+ pumpkinseed, Chironomidae had the highest weight percentage (40.5%), followed by Elmidae (25.4%) and Annelida (24.4%). Chydoridae had the highest weight frequency for 6+ pumpkinseed at 50.0 percent, followed by Chironomidae larvae and Hydroptilidae, at 23.1 percent each.

Frequency of occurrence for prey items consumed by pumpkinseed are listed in Table 3.159. Chironomidae larvae had the highest occurrence frequency for 0+ pumpkinseed at 100 percent, followed by Tricorythidae, Oaphnidae and Ostracoda at 66.7 percent each. For 2+ pumpkinseed, Chironomidae larvae had an occurrence frequency of 100 percent, followed by Hydroptilidae, Oaphnidae and Gammaridae, at 37.5 percent each. Chironomidae larvae had the highest frequency of occurrence for 3+ pumpkinseed at 58.3 percent, followed by Hydroptilidae at 36.7 percent and Planorbidae at 32.8 percent. For 4+ pumpkinseed, Chironomidae larvae had the highest frequency of occurrence at 61 .1 percent, followed by Planorbidae (47.2%) and Chironomidae pupae (19.4%). Chironomidae larvae had the highest occurrence frequency at 92.6 percent for 5+ pumpkinseed, followed by Planorbidae at 88.9 percent and

Table 3.157. Mean annual number frequencies of prey items consumed by pumpkinseed for 1988, Pend **Oreille** River, WA.

	0 +	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=3	N=6	N=18	N=12	N=12	N=2	N=53
TRICHOPTERA (caddisflies)							
Hydroptilidae		1.8	3.1	2.8	2.5	25.0	5.9
Lepidostomatidae			0.3				<0.1
Leptoceridae			0.3	1.9			0.4
Glossosomatidae					0.5		<0.1
Phryganeidae					0.1		<0.1
EPHEMEROPTERA (mayflies)							
Baetidae		0.6	0.1	0.8			0.3
Leptophlebidae					0.5		<0.1
Tricorythidae	3.3		0.3				0.6
ODONATA (dragonflies, damselflies)							
Coenagrionidae		0.6	0.5	2.6	0.1		0.6
Libellulidae		1.4	0.3				0.3
COLEOPTERA (beetles)							
Elmidae		12.2	5.3	9.1	15.5		7.0
HYDRACARINA (water mites)		0.6	6.9	1.9	1.6		1.8
DIPTERA (midges, flies)							
Chironomidae larvae	32.2	58.3	62.4	42.6	66.4	17.9	46.6
Chironomidae pupae		0.6	1.0	4.8	3.4	7.2	2.8
Tipulidae				3.7	0.2		0.7
Ceratopogonidae			0.3	0.6			0.2
Muscidae				1.9			0.3
COPEPODA							
Cyclopoida		0.9	0.4	0.9			0.4
CLADOCERA (water fleas)							
Daphnidae	5.6	11.4	1.5	0.5			3.2
Chydoridae		2.7	2.7	1.6	0.4	50.0	9.6
AMPHIPODA (scuds)							
Talitridae		0.3	0.1				<0.1
Gammaridae		3.6	1.0	7.4	0.2		2.0
OSTRACODA (seed shrimp)	48.9	2.7			0.5		8.7
GASTROPODA (snails)							
Planorbidae	10.0	0.9	10.7	11.7	4.7		6.3
Lymnaeidae			1.1	2.3	0.2		0.6
OLIGOCHAETA (worms)							
Lumbriculidae		1.0	2.2	1.9			0.9
ANNELIDA			0.3		1.6		0.3
NEMATODA		0.4	0.3	0.1			0.1
BIVALVE (clams)							
Sphaeriidae		0.6	1.0	0.1			0.3
CESTODA (tapeworms)				0.1			<0.1
TERRESTRIAL INSECTA		0.6	1.8	0.7			0.5

Table 3.158. Mean annual weight frequencies of prey items consumed by pumpkinseed for 1988, Pend Oreille River, WA.

	o+	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=3	N=6	N=18	N=12	N=12	N=2	N=53
TRICHOPTERA (caddisflies)							
Hydroptilidae		0.4	16.2	1.0	0.2	23.1	7.2
Lepidostomatidae			<0.1				co.1
Leptoceridae			1.7	<0.1			0.3
Glossosomatidae					0.2		co.1
Phryganeidae					co.1		co.1
EPHEMEROPTERA (maytlies)							
Baetidae			co.1	0.7			0.1
Le tophlebidae		0.6			3.4		0.7
Tricorythidae	20.0		<0.1				3.4
ODONATA (dragonflies, damselflies)							
Coenagrionidae		0.6	4.9	1.7	<0.1		1.2
Libellulidae		1.8	1.3				0.5
COLEOPTERA (beetles)							
Elmidae		6.8	1.9	5.9	25.4		6.7
HYDRACARINA (water mites)		1.9	co.1	0.1	0.3		0.4
DIPTERA (midges, flies)							
Chironomidae larvae	20.0	37.7	16.6	29.6	40.5	23.1	27.9
Chironomidae pupae		0.6	0.6	3.8	0.1	3.9	1.5
Tipulidae				0.4	<0.1		<0.1
Ceratopogonidae			co.1	0.2			co.1
Muscidae				2.1			0.4
COPEPODA							
Cyclopoida		1.9	<0.1	0.2			0.4
CLADOCERA (water fleas)							
Daphnidae	20.0	2.4	<0.1	0.1			3.8
Chydoridae		1.9	1.6	0.7	<0.1	50.0	9.1
AMPHIPODA (scuds)							
Talitridae		1.9	<0.1				0.3
Gammaridae		3.9	<0.1	0.2	0.3		0.8
OSTRACODA (seed shrimp)	20.0	1.9			3.1		4.2
GASTROPODA (snails)							
Planorbidae	20.0	1.9	8.6	21.9	1.8		9.0
Lymnaeidae			1.1	19.5	0.2		3.5
OLIGOCHAETA (worms)							
Lumbriculidae		12.6	42.2	9.8			10.7
ANNELIDA			0.3		24.4		4.1
NEMATODA		0.4	0.3	<0.1			0.1
BIVALVE (clams)							
Sphaeriidae		0.6	1.0	0.1			0.3
CESTODA (tapeworms)							
TERRESTRIAL INSECTA		18.8	1.8	1.4			3.7

Table 3.159. Mean annual occurrence frequencies of prey items consumed by pumpkinseed for 1988, Pend **Oreille** River, WA.

	0 +	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=3	N=6	N=18	N=12	N=12	N=2	N=53
TRICHOPTERA (caddisflies)							
Hydroptilidae		37.5	36.7	5.6	59.3	50.0	31.5
Lepidostomatidae			2.8				0.5
Leptoceridae			2.8	8.3			1.9
Glossosomatidae					16.7		2.8
Phryganeidae					3.7		0.6
EPHEMEROPTERA (mayflies)							
Baetidae		12.5	6.7	5.6			4.1
Leptophlebidae					16.7		2.8
Tricorythidae	66.7		2.8				11.6
ODONATA (dragonflies, damselflies)							
Coenagrionidae		12.5	13.3	16.7	3.7		7.7
Libellulidae		12.5	2.8				2.6
COLEOPTERA (beetles)							
Elmidae		25.0	17.8	13.9	33.3		15.0
HYDRACARINA (water mites)		25.0	16.1	11.1	57.4		18.3
DIPTERA (midges, flies)							
Chironomidae larvae	100.0	100.0	58.3	61.1	92.6	50.0	77
Chironomidae pupae		12.5	20.0	19.4	55.6	50.0	26.3
Tipulidae				8.3	7.4		2.6
Ceratopogonidae			2.8	5.6			1.4
Muscidae				8.3			1.4
COPEPODA							
Cyclopoida		25.0	6.1	16.7			8.0
CLADOCERA (water fleas)							
Daphnidae	66.7	37.5	15.0	5.6			20.8
Chydoridae		25.0	20.0	11.1	7.4	50.0	18.9
AMPHIPODA (scuds)							
Talitridae		25.0	6.7				5.3
Gammaridae		37.5	12.2	16.7	33.3		16.6
OSTRACODA (seed shrimp)	66.7	25.0			24.1		19.3
GASTROPODA (snails)							
Planorbidae	33.3	25.0	32.8	47.2	88.9		37.9
Lymnaeidae			12.2	8.3	16.7		6.2
OLIGOCHAETA (worms)							
Lumbriculidae		12.5	20.6	8.3			6.9
ANNELIDA			6.7		3.7		1.7
NEMATODA		12.5	2.8	5.6			3.5
BIVALVE (clams)							
Sphaeriidae		12.5	12.2	5.6			5.1
CESTODA (tapeworms)				5.6			0.9
TERRESTRIAL INSECTA		12.5	8.3	11.1			5.3

Hydroptilidae at 59.3 percent. For 6+ pumpkinseed, Hydroptilidae, Chironomidae larvae, Chironomidae pupae and Chydoridae each made up 50 percent in occurrence.

Index of relative importance for prey items consumed by pumpkinseed are listed in Table 3.160. Chironomidae larvae had the highest IRI for 0+ pumpkinseed at 28.5 percent, followed by Ostracoda (25.4%) and Daphnidae (17.3%). For 2+ pumpkinseed, Chironomidae larvae had the highest IRI at 28.4 percent, followed by Daphnidae at 7.4 percent and Gammaridae at 6.5 percent. Chironomidae larvae had the highest IRI for 3+ pumpkinseed at 25.5 percent, followed by Lumbriculidae (12.1%) and Hydroptilidae (10.4%). For 4+ pumpkinseed, Chironomidae larvae had the highest IRI at 26.4 percent, followed by Planorbidae (16.0%) and Lymnaeidae (6.0%). Chironomidae larvae had the highest IRI at 27.8 percent for 5+ pumpkinseed, followed by Planorbidae at 13.3 percent and Elmidae at 10.3 percent. At age 6+, Chydoridae had the highest IRI at 37.5 percent, followed by Hydroptilidae (24.5%) and Chironomidae larvae (22.7%).

In general, pumpkinseed of all ages combined, fed predominately on Chironomidae larvae, (IRI of 26.5%) (Table 3.160). Other high IRI values were for Planorbidae (9.2%) and Hydroptilidae **(8.6%).**

3.6.6 BROWN TROUT FEEDING HABITS

A total of 28 brown trout stomachs were analyzed in 1988, and nineteen families of invertebrates were identified in their stomachs.

Percent composition by number for prey organisms in brown trout stomachs are listed in Table 3.161. Elmidae had the highest numerical frequency for 0+ brown trout at 66.7 percent, followed by Baetidae at 33.3 percent. For 1+ brown trout, Coenagrionidae had the highest numerical frequency (31.3%) followed by terrestrial insecta (21.5%). Coenagrionidae had the highest numerical percentage for 2+ brown trout at 32.9 percent, followed by Chironomidae larvae at 26.7 percent and Baetidae and Osteichthyes at 16.7 percent each. For 3+ brown trout, terrestrial insecta had the highest numerical frequency at 21.5 percent, followed by Formicidae (18.6%) and Baetidae (11.1%). Terrestrial insecta had the highest numerical frequency for 4+ brown trout at 54.6 percent, followed by Elmidae and Chironomidae pupae at 18.2 percent each. For 5+ brown trout,

Table 3.160. Mean annual index of relative importance (IRI) frequencies of prey items consumed by pumpkinseed for 1988, Pend Oreille River, WA.

	0 +	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=3	N=6	N=18	N=12	N=12	N=2	N=53
TRICHOPTERA (caddisflies)							
Hydroptilidae		0.6	10.4	1.9	8.6	24.5	8.6
Lepidostomatidae			0.6				0.1
Leptoceridae			0.9	2.0			0.5
Glossosomatidae					2.4		0.4
Phryganeidae					0.5		<0.1
EPHEMEROPTERA (mayflies)							
Baetidae		2.0	1.3	1.4			0.8
Leptophlebidae					2.9		0.5
Tricorythidae	16.9		0.6				2.9
ODONATA (dragonflies, damselflies)							
Coenagrionidae		2.0	3.5	4.2	0.5		1.7
Libellulidae		2.3	0.8				0.5
COLEOPTERA (beetles)							
Elmidae		6.4	4.6	5.7	10.3		4.5
HYDRACARINA (water mites)		4.0	3.3	2.6	8.3		3.0
DIPTERA (midges, flies)							
Chironomidae larvae	28.5	28.4	25.5	26.4	27.8	22.7	26.5
Chironomidae pupae		2.0	4.0	5.5	8.2	15.3	5.8
Tipulidae				2.5	1.1		0.6
Ceratopogonidae			0.6	1.3			0.3
Muscidae				2.4			0.4
COPEPODA							
Cyclopoida		4.0	1.2	3.5			1.5
CLADOCERA (water fleas)							
Daphnidae	17.3	7.4	3.1	1.2			4.8
Chydoridae		4.3	4.5	2.7	1.1	37.5	8.4
AMPHIPODA (scuds)							
Talitridae		3.9	1.3				0.9
Gammaridae		6.5	2.5	4.8	4.7		3.1
OSTRACODA (seed shrimp)	25.4	4.3			3.9		5.6
GASTROPODA (snails)							
Planorbidae	11.9	4.0	9.7	16.0	13.3		9.2
Lymnaeidae			2.7	6.0	2.4		1.9
OLIGOCHAETA (worms)							
Lumbriculidae		3.8	12.1	4.0			3.3
ANNELIDA			1.6		4.1		1.0
NEMATODA		1.9	0.6	1.1			0.6
BIVALVE (clams)							
Sphaeriidae		2.0	2.7	1.1			1.0
CESTODA (tapeworms)				1.1			0.2
TERRESTRIAL INSECTA		4.6	1.9	2.6			1.5

Table 3.161. Mean annual number frequencies of prey items consumed by brown **trout** for 1988, Pend Oreille River, WA.

	0 +	1 +	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=2	N=8	N=7	N=6	N=3	N=1	N=1	N=28
TRICHOPTERA (caddisflies)								
Hydroptilidae		2.1	0.3					0.9
Leptoceridae				11.1				1.6
EPHEMEROPTERA (mayflies)								
Baetidae	33.3	7.2	16.7	11.1			50.0	16.9
ODONATA (dragonflies, damselflies)								
Coenagriondae		31.3	32.9					9.2
Libellulidae		0.7						0.1
COLEOPTERA (beetles)								
Elmidae	66.7	0.7	0.6		18.2			12.3
DIPTERA (midges, flies)								
Chironomidae larvae		16.2	26.7	0.2	9.1	37.5		12.8
Chironomidae pupae		13.2		2.4	18.2	25.0		8.4
COPEPODA								
Cyclopoida						12.5		1.8
CLADOCERA (water fleas)								
Chydoridae				3.1		25.0		4.0
GASTROPODA (snails)								
Planorbidae		7.2		5.6				1.8
Lymnaeidae								
OSTEICHTHYES (fish)			16.7					2.4
TERRESTRIAL INSECTA		21.5	5.8	21.5	54.6			14.8
DIPTERA								
Chironomidae Adult				0.2				<0.1
COLEOPTERA								
Cerambycidae				0.1				<0.1
HEMIPTERA								
Corixidae							50.0	7.1
Lygaeidae				6.2				0.9
Pentatomidae				0.1				<0.1
HOMOPTERA								
Aphididae				4.3				0.6
Cicadellidae				5.8				0.8
HYMEMOPTERA								
Orussidae				10.0				1.4
Formicidae				18.6				2.6

Chironomidae larvae had the highest numerical frequency at 37.5 percent, followed by Chironomidae pupae and Chydoridae at 25.0 percent each. Baetidae and Corixidae each made up 50 percent by number for 6+ brown trout.

Table 3.162 lists percent composition by weight for prey items consumed by brown trout. Elmidae had the highest weight percentage for 0+ brown trout at 66.7 percent, followed by Baetidae at 33.3 percent. For 1+ brown trout, terrestrial insecta had the highest weight percentage at 49.6 percent followed by Coenagrionidae (25.5%) and Libellulidae (23.1%.) Coenagrionidae had the highest weight frequency for 2+ brown trout at 58.7 percent, followed by Osteichthyes at 33.2 percent and Elmidae at 5.1 percent. For 3+ brown trout, terrestrial insecta had the highest weight frequency at 41 .1 percent, followed by Formicidae at 15.7 percent and Planorbidae at 12.6 percent. Elmidae had the highest percent by weight at 94.6 percent for 4+ brown trout, followed by terrestrial insecta at 4.7 percent. For 5+ brown trout; Chironomidae larvae, Chironomidae pupae, Cyclopoida and Chydoridae all had weight frequencies of 25 percent. Baetidae had the highest weight frequency for 6+ brown trout at 97.2 percent, followed Corixidae at 2.8 percent.

Frequency of occurrence for prey items consumed by brown trout are listed in Table 3.163. For 0+ brown trout, Baetidae and Elmidae each made up 50 percent by occurrence. Coenagrionidae had the highest occurrence frequency for 1+ brown trout at 50 percent, followed by Chironomidae larvae at 37.5 percent. For 2+ brown trout, Coenagrionidae and Chironomidae larvae had the highest occurrence frequency at 44.3 percent each, followed by Planorbidae at 33.2 percent. Terrestrial insecta had the highest occurrence frequency at 62.5 percent for 3+ brown trout, followed by Leptoceridae, Baetidae and Planorbidae at 50.0 percent each. For 4+ brown trout; Elmidae, Chironomidae larvae, and Chironomidae pupae occurred in the stomach 100 percent. In 5+ brown trout; Chironomidae larvae, Chironomidae pupae, Cyclopoida and Chydoridae occurred in the stomach 100 percent. Baetidae and Corixidae occurred in the stomach 100 percent for 6+ brown trout.

Index of relative importance (IRI) for brown trout prey items are listed in Table 3.164. Elmidae had the highest IRI for 0+ brown trout at 55.6 percent, followed by Baetidae at 44.4 percent. For 1+ brown trout, Coenagrionidae had the highest IRI at 28.4 percent,

Table 3.162. Mean annual weight frequencies of prey items consumed by brown trout for 1988, Pend Oreille River, WA.

PREY ORGANISMS	0 + N=2	1 + N=8	2 + N=7	3 + N=6	4 + N=3	5 + N=1	6 + N=1	ALL AGES N=28
TRICHOPTERA (caddisflies)								
Hydroptilidae		0.3	0.2					0.1
Leptoceridae				3.2				0.4
EPHEMEROPTERA (mayflies)								
Baetidae	33.3	0.1	0.1	1.9			97.2	18.9
ODONATA (dragonflies, damselflies)								
Coenagrionidae		25.5	58.7					12.0
Libellulidae		23.1						3.3
COLEOPTERA (beetles)								
Elmidae	66.7	0.1	5.1		94.6			23.8
DIPTERA (midges, flies)								
Chironomidae larvae		0.8	0.6	<0.1	0.2	25.0		3.8
Chironomidae pupae		1.1		0.3	0.2	25.0		3.9
COPEPODA								
Cyclopoida						25.0		3.6
CLADOCERA (water fleas)								
Chydoridae				0.1		25.0		3.6
GASTROPODA (snails)								
Planorbidae		0.1		12.6				1.8
OSTEICHTHYES (fish)			33.2					4.7
TERRESTRIAL INSECTA		49.6	2.1	41.1	4.7			13.9
DIPTERA								
Chironomidae Adult				0.1				<0.1
COLEOPTERA								
Cerambycidae				0.1				<0.1
HEMIPTERA								
Corixidae							2.8	0.4
Lygaeidae				5.0				0.7
Pentalomidae				1.2				0.2
HOMOPTERA								
Aphididae				0.6				0.1
Cicadellidae				7.0				1.0
HYMENOPTERA								
Orussidae				11.5				1.6
Formicidae				15.7				2.2

Table 3.163. Mean annual occurrence frequencies of prey items consumed by brown trout for 1988, Pend Oreille River, WA.

	0 +	1 +	2 +	3 +	4 +	5 +	6 +	ALL AGES
PREY ORGANISMS	N=2	N=8	N=7	N=6	N-3	N=1	N=1	N-28
TRICHOPTERA (caddisflies)								
Hydroptilidae		12.5	11.1					3.4
Leptoceridae				50.0				7.1
EPHEMEROPTERA (mayflies)								
Baelidae	50.0	12.5	11.1	50.0			100.0	31.9
ODONATA (dragonflies, damselflies)								
Coenagrionidae		50.0	44.4					13.5
Libellulidae		12.5						1.8
COLEOPTERA (beetles)								
Elmidae	50.0	12.5	11.1		100.0			24.6
DIPTERA (midges, flies)								
Chironomidae larvae		37.5	44.3	25.0	100.0	100.0		43.8
Chironomidae pupae		12.5		33.3	100.0	100.0		35.1
COPEPODA								
Cyclopoida						100.0		14.3
CLADOCERA (water fleas)								
Chydoridae				12.5		100.0		16.1
GASTROPODA (snails)								
Planorbidae		12.5	33.2	50.0				13.7
OSTEICHTHYES (fish)			11.1					1.6
TERRESTRIAL INSECTA		12.5	2.1	62.5	33.3			15.8
DIPTERA								
Chironomidae Adult				6.3				1.2
COLEOPTERA								
Cerambycidae				0.3				1.2
HEMIPTERA								
Corixidae							100.0	14.3
Lygaeidae				29.2				4.2
Pentatomidae				12.5				1.8
HOMOPTERA								
Aphididae				16.7				2.4
Cicadellidae				29.2				4.2
HYMENOPTERA								
Orussidae				37.5				5.4
Formicidae				37.5				5.4

followed by terrestrial insecta (22.2%) and Chironomidae larvae (14.5%). Coenagrionidae had the highest IRI for 2+ brown trout at 34.0 percent, followed by Osteichthyes at 22.9 percent and Chironomidae larvae at 18.0 percent. For 3+ brown trout, terrestrial insecta had the highest IRI at 20.3 percent, followed by Planorbidae (11.4%) and Leptoceridae (10.7%). Elmidae had the highest IRI at 39.9 percent for 4+ brown trout, followed by Chironomidae pupae (22.2%) and Chironomidae larvae (20.5%). For 5+ brown trout, Chironomidae larvae had the highest IRI at 27.1 percent followed by Chironomidae pupae and Chydoridae at 25.0 percent each. Baetidae had the highest IRI for 6+ brown trout at 61.8 percent, followed by Corixidae (38.2%).

Baetidae, Elmidae, and Chironomidae larvae had the highest IRI for all ages of brown trout combined at 18.9 percent, 14.7 percent and 11.9 percent, respectively (Table 3.164). However, at certain times terrestrial insects were very important in brown trout diets (Appendix H).

3.6.7 CUTTHROAT TROUT FEEDING HABITS

Only eight cutthroat trout were encountered during fishery surveys in 1988. Ten families of aquatic invertebrates and 18 families of terrestrial insects were identified in cutthroat stomachs.

Table 3.165 lists the percent composition by number for prey items consumed by cutthroat trout. For 2+ cutthroat trout, Formicidae had the highest numerical frequency at 27.2 percent, followed by Nematoda at 22.3 percent and Chironomidae pupae at 14.4 percent. Aphididae had the highest number percent at 27.5 percent for 3+ cutthroat trout, followed by Lygaeidae (18.9%) and Cicadellidae (16.4%).

Percent composition by weight for prey items consumed by cutthroat trout are listed in Table 3.166. Chironomidae pupae had the highest weight frequency for 2+ cutthroat trout at 32.3 percent, followed by Lumbriculidae at 16.3 percent and Formicidae at 15.7 percent. For 3+ cutthroat trout, Cicadellidae had the highest weight frequency at 36.2 percent, followed by Orussidae (29.4%) and Lygaeidae (14.2%).

Table 3.167 lists the frequency of occurrence for prey items consumed by cutthroat trout. Chironomidae pupae and Nematoda had

Table 3.164. Mean annual index of relative importance **(IRI)** frequencies of prey items consumed by brown trout for 1988, **Pend** Oreille River, WA.

	0+	1+	2+	3+	4+	5+	6+	ALL AGES
PREY ORGANISMS	N=2	N=8	N=7	N=6	N=3	N=1	N=1	N-26
TRICHOPTERA (caddisflies)								
Hydroptilidae		4.0	3.0					0.1
Leptoceridae				10.7				1.5
EPHEMEROPTERA (mayflies)								
Baetidae	44.4	5.3	10.5	10.5			61.8	16.9
ODONATA (dragonflies, damselflies)								
Coenagrionidae		26.4	34.0					6.9
Libellulidae		9.7						1.4
COLEOPTERA (beetles)								
Elmidae	55.6	3.5	4.2		39.9			14.7
DIPTERA (midges, flies)								
Chironomidae larvae		14.5	18.0	3.4	20.5	27.1		11.9
Chironomidae pupae		7.1		4.9	22.2	25.0		8.4
COPEPODA								
Cyclopoida						22.9		3.3
CLADOCERA (water fleas)								
Chydoridae				2.1		25.0		3.9
GASTROPODA (snails)								
Planorbidae		5.3		11.4				2.4
OSTEICHTHYES (fish)			22.9					3.3
TERRESTRIAL INSECTA		22.2	7.5	20.3	17.4			9.6
DIPTERA								
Chironomidae Adult				1.2				0.2
COLEOPTERA								
Cerambycidae				1.2				0.2
HEMIPTERA								
Corixidae							38.2	5.4
Lygaeidae		.		5.6				0.8
Pentatomidae				1.6				0.2
HOMOPTERA								
Aphididae				3.1				0.4
Cicadellidae				5.4				0.6
HYMENOPTERA								
Orussidae				6.3				1.2
Formicidae				1				1.4

Table 3.165. Mean annual number frequencies of prey items consumed by cutthroat trout for 1988, Pend Oreille River, WA.

PREY ORGANISMS	2+ n=6	3+ n=2	All Ages n=8
TRICHOPTERA (caddisflies)			
Hydroptilidae	7.2		3.6
Rhyacophilidae	1.9		1.0
EPHEMEROPTERA (mayflies)			
Baetidae			
Ephemerellidae	7.2		3.6
HYDRACARINA (water mites)	0.9		0.5
DIPTERA (midges, flies)			
Chironomidae pupae	14.4	15.6	15.0
Tipulidae	1.9		1.0
GASROPODA (snails)			
Planorbidae	3.4		1.7
OSTEICHTHYES (fish)			
Cottidae (sculpin)	0.2		0.1
OLIGOCHAETA (worms)			
Naididae	1.0		0.5
Lumbriculidae	9.2		4.6
NEMATODA	22.3		11.2
TERRESTRIAL INSECTA			
DIPTERA			
Simuliidae Adults	0.5	0.7	0.6
Muscidae Adults	<0.1	0.4	0.3
Phoridae	<0.1		<0.1
Chloropidae	<0.1		<0.1
COLEOPTERA			
Cleridae	<0.1		<0.1
Curculionidae	0.1		<0.1
Staphylinidae	<0.1		<0.1
HEMIPTERA			
Corixidae	0.7		0.4
Lygaeidae	<0.1	18.9	9.5
HOMOPTERA			
Aphididae	<0.1	27.5	13.8
Cicadellidae	0.6	16.4	8.5
Psocidae	<0.1		<0.1
HYMENOPTERA			
Formicidae	27.2	6.4	16.8
Orussidae	<0.1	14.3	7.2
Sierolomorphidae	<0.1		<0.1
Apidae	<0.1		<0.1
NEUROPTERA			
Coniopterygidae	<0.1		<0.1
ORTHOPTERA			
Acrididae	0.3		0.2

Table 3.166. Mean annual weight frequencies of prey items consumed by cutthroat trout for 1988, Pend Oreille River, WA.

	2+	3+	All Ages
PREY ORGANISMS	n=6	n=2	n=8
TRICHOPTERA (caddisflies)			
Hydroptilidae	5.3		2.7
Rhyacophilidae	1.2		0.6
EPHEMEROPTERA (mayflies)			
Baetidae			
Ephemerellidae	2.5		1.3
HYDRACARINA (water mites)	0.1		<0.1
DIPTERA (midges, flies)			
Chironomidae pupae	32.3	2.3	17.3
Tipulidae	1.3		0.7
GASROPODA (snails)			
Planorbidae	2.7		1.4
OSTEICHTHYES (fish)			
Cottidae (sculpin)	3.8		1.9
OLIGOCHAETA (worms)			
Naldidae	<0.1		<0.1
Lumbriculidae	16.3		8.2
NEMATODA	4.2		2.1
TERRESTRIAL INSECTA			
DIPTERA			
Simuliidae Adults	<0.1	0.2	0.2
Muscidae Adults	0.2	0.2	0.2
Phoridae	<0.1		<0.1
Chloropidae	<0.1		<0.1
COLEOPTERA			
Cleridae	<0.1		<0.1
Curculionidae	0.1		<0.1
Staphylinidae	0.1		<0.1
HEMIPTERA			
Corixidae	1.3		0.7
Lygaeidae	<0.1	14.2	7.2
HOMOPTERA			
Aphididae	0.5	6.9	3.7
Cicadellidae	0.2	36.2	18.2
Psocidae	8.5		4.3
HYMENOPTERA			
Formicidae	15.7	10.7	13.2
Orussidae	0.6	29.4	15.0
Sierolomorphidae	<0.1		<0.1
Apidae	<0.1		<0.1
NEUROPTERA			
Coniopterygidae	<0.1		<0.1
ORTHOPTERA			
Acrididae	1.6		0.8

the highest occurrence frequency for 2+ cutthroat trout at 55.6 percent and 44.4 percent, respectively. For 3+ cutthroat trout, Cicadellidae, Formicidae, Aphididae and Lygaeidae were present in 100 percent of the stomachs.

Index of relative importance for prey items consumed by cutthroat trout are listed in Table 3.168. Chironomidae pupae had the highest IRI for 2+ cutthroat trout at 11.5 percent, followed by Formicidae (8.6%) and Nematoda (8.0%). For 3+ cutthroat trout, Cicadellidae had the highest IRI at 19.1 percent followed by Aphididae at 16.8 percent and Orussidae at 16.6 percent.

In general, cutthroat trout of all ages feed predominantly on terrestrial insecta, with Formicidae, Cicadellidae and Aphididae having the highest IRI at 11.6 percent, 11.5 percent and 9.1 percent respectively (Table 3.168).

3.6.8 NON-TARGET FISH FEEDING HABITS

Non-target fish species include; tench, redside shiner, brown bullhead, longnose sucker, largescale sucker, peamouth and northern squawfish. Stomachs on non-target species were only taken periodically, so sample sizes were small. Results on percent composition by number, weight, and occurrence for non-target fish are listed in Appendix H.

Index of relative importance for prey items consumed by non-target fish are listed in Appendix H. Chydoridae had the highest IRI for tench at 23.7 percent, followed by Ostracoda (22.4%) and Chironomidae larvae (14.9%). For redside shiners, terrestrial insecta had the highest IRI at 55.6 percent, followed by Chironomidae pupae (22.3%) and Simuliidae (22.3%). Chironomidae larvae had the highest IRI for brown bullhead at 37.0 percent, followed by Planorbidae (16.8%) and Ceratopogonidae (7.8%). For longnose sucker, Ostracoda had the highest IRI at 15.4 percent, followed by Chironomidae larvae at 14.9 percent and Hydracarina at 13.2 percent. Sphaeriidae had the highest IRI at 14.8 percent for largescale suckers, followed by Daphnidae (14.6%) and Chironomidae larvae (13.4%). For peamouth, Sphaeriidae had the highest IRI at 50.0 percent, followed by Planorbidae at 37.0 percent and Lymnaeidae at 29.0 percent. Chironomidae larvae had the highest IRI for northern squawfish at 21.4 percent, followed by Nematoda (17.2%) and yellow perch (16.7%).

Table 3.167. Mean annual occurrence frequencies of prey items consumed by cutthroat trout for 1988, Pend Oreille River, WA.

	2+	3+	All Ages
PREY ORGANISMS	n=6	n=2	n=8
TRICHOPTERA (caddisflies)			
Hydroptilidae	33.3		16.7
Rhyacophilidae	33.3		16.7
EPHEMEROPTERA (mayflies)			
Baetidae			
Ephemerellidae	33.3		16.7
HYDRACARINA (water mites)	33.3		16.7
DIPTERA (midges, flies)			
Chironomidae pupae	55.6	50.0	52.8
Tipulidae	33.3		16.7
GASROPODA (snails)			
Planorbidae	33.3		16.7
OSTEICHTHYES (fish)			
Cottidae (sculpin)	33.3		16.7
OLIGOCHAETA (worms)			
Naididae	33.3		16.7
Lumbriculidae	33.3		16.7
NEMATODA	44.4		22.2
TERRESTRIAL INSECTA			
DIPTERA			
Simuliidae Adults	22.2	50.0	36.1
Muscidae Adults	11.1	50.0	30.6
Phoridae	11.1		5.6
Chloropidae	11.1		5.6
COLEOPTERA			
Cleridae	11.1		5.6
Curculionidae	22.2		11.1
Staphylinidae	11.1		5.6
HEMIPTERA			
Corixidae	22.2		11.1
Lygaeidae	11.1	100.0	55.6
HOMOPTERA			
Aphididae	11.1	100.0	55.6
Cicadellidae	33.3	100.0	66.5
Psocidae	11.1		5.6
HYMENOPTERA			
Formicidae	33.3	100.0	66.5
Orussidae	11.1	50.0	30.6
Sierolomorphidae	11.1		5.6
Apidae	22.2		11.1
NEUROPTERA			
Coniopterygidae	11.1		5.6
ORTHOPTERA			
Acrididae	11.1		5.6

Table 3.168. Mean annual index of relative importance (IRI) frequencies of prey items consumed by cutthroat trout for 1988, Pend Oreille River, WA.

PREY ORGANISMS	2+ n=6	3+ n=2	All Ages n=8
TRICHOPTERA (caddisflies)			
Hydroptilidae	5.2		2.6
Rhyacophilidae	4.1		2.1
EPHEMEROPTERA (mayflies)			
Baetidae			
Ephemerellidae	4.8		2.4
HYDRACARINA (water mites)	3.9		2.0
DIPTERA (midges, flies)			
Chironomidae pupae	11.5	8.5	10.0
Tipulidae	4.1		2.1
GASROPODA (snails)			
Planorbidae	4.4		2.2
OSTEICHTHYES (fish)			
Cottidae (sculpin)	4.2		2.1
OLIGOCHAETA (worms)			
Naididae	3.9		2.0
Lumbriculidae	6.6		3.3
NEMATODA	8.0		4.0
TERRESTRIAL INSECTA			
DIPTERA			
Simuliidae Adults	2.6	6.4	4.5
Muscidae Adults	1.3	6.3	3.8
Phoridae	1.3		0.7
Chloropidae	1.3		0.7
COLEOPTERA			
Cleridae	1.3		0.7
Curculionidae	2.5		1.3
Staphylinidae	1.3		0.7
HEMIPTERA			
Corixidae	2.7		1.4
Lygaeidae	1.3	16.6	9.0
HOMOPTERA			
Aphididae	1.3	16.8	9.1
Cicadellidae	3.8	19.1	11.5
Psocidae	2.2		1.1
HYMENOPTERA			
Formicidae	8.6	14.6	11.6
Orussidae	1.3	11.7	6.5
Sierolomorphidae	1.3		0.7
Apidae	2.5		1.3
NEUROPTERA			
Coniopterygidae	1.3		0.7
ORTHOPTERA			
Acrididae	1.5		0.8

3.6.9 PREY SELECTION (ELECTIVITY)

3.6.9.1 ZOOPLANKTON ELECTIVITY

Electivity index calculations for consumption of zooplankton by fish in Pend Oreille River are presented in Table 3.169. For yellow perch, Daphnidae (+0.260) and Chydoridae (+0.355) had the highest electivities. For largemouth bass, Chydoridae and Daphnidae had the highest electivity at +0.510 and +0.285, respectively. Mountain whitefish had highest electivity for Chydoridae (+0.485) and Daphnidae (+0.319). For black crappie, Daphnidae had the highest electivity at +0.394, followed by Chydoridae at +0.186. For pumpkinseed, Chydoridae had the highest electivity at +0.712 followed by Daphnidae (+0.068). Chydoridae had the highest electivity for brown trout at +0.675. For brown bullhead, Daphnidae had the highest electivity at +0.583, followed by Chydoridae at +0.120. For tench, Chydoridae had the highest electivity at +0.594. Daphnidae had the highest electivity in largescale suckers (+0.826). For the longnose sucker, Chydoridae had the highest electivity at +0.969. Peamouth and northern squawfish had negative electivity for all types of zooplankton. Generally, nearly all fish seemed to select Daphnidae and Chydoridae, while other Cladocera and Copepoda were ignored (negative electivity values).

3.6.9.2 BENTHIC MACROINVERTEBRATE ELECTIVITY

Prey selection for benthic macroinvertebrates consumed by target fish species are listed in Table 3.170. For yellow perch, electivity was highest for Baetidae (+0.167) followed by Hydracarina (+0.132). Baetidae were selected the most by largemouth bass at +0.393, followed by Chironomidae pupae at +0.138. For mountain whitefish, Chironomidae larvae had the highest electivity (+0.296), followed by Chironomidae pupae (+0.116). Baetidae were selected the most by black crappie at +0.393, followed by Chironomidae pupae at +0.138. Pumpkinseed had the highest prey selection for Chironomidae larvae (+0.241), followed by Hydroptilidae (+0.052). Brown trout selected Baetidae and Elmidae at +0.259 and +0.159, respectively. For cutthroat trout, highest electivity was for Chironomidae pupae (+0.288) and Nematoda (+0.093).

Results for prey selection by non-target fish species are listed in Table 3.171. Brown bullhead had the highest electivity for Chironomidae larvae (+0.661). For tench, highest prey selection was

Table 3.169. Prey selection (electivlty) for zooplankton by fish species for 1988, Pend Oreille River, WA.

		Yellow perch	Lrgmouth Bass	Mountain whitefish	Black crappie	Pumpkin-seed	Brown trout	Brown bullhead	Tench	Peamouth	Northern squawfish	Lrgscale sucker	Longnose sucker
	%[1]	N=565	N321	N=208	N=103	N=53	N=28	N=10	N=7	N=2	N=12	N=3	N=3
CLADOCERA													
Daphnidae	17.4	+0.260	+0.285	+0.319	+0.394	+0.068	-0.174	+0.583	-0.174	-0.174	-0.174	+0.826	-0.174
Chydoridae	1.5	+0.355	+0.510	+0.485	+0.186	+0.712	+0.675	+0.120	+0.594	-0.015	-0.015	-0.015	+0.969
Sididae	1.9	-0.019	-0.019	-0.019	-0.018	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019	-0.019
Leptodoridae	0.1	-0.001	-0.001	-0.001	0.0	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
COPEPODA													
Calanoida	40.4	-0.377	-0.399	-0.404	-0.359	-0.400	-0.094	-0.404	-0.404	-0.404	-0.404	-0.404	-0.404
Cyclopoida	37.7	-0.208	-0.367	-0.370	-0.195	-0.347	-0.377	-0.269	+0.013	-0.377	-0.377	-0.377	-0.361
Harpacticoida	1.0	+1.0	-0.010	-0.010	-0.010	-0.001	-0.010	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001

[1] [%] is the percent composition in zooplankton tows.

Table 3.170. Prey selection (electlvity) for benthic macroinvertebrates by target fish species for 1988, Pend Oreille River, WA.

ORGANISMS	%[1]	Yellow perch	Lrgmouth bass	Mountain whitefish	Black crappie	Pumpkin-seed	Brown trout	Cutthroat trout
		N=565	N=321	N=208	N=103	N=53	N=28	N=8
TRICHOPTERA								
Hydroptilidae	1.1	+0.058	-0.007	+0.036	-0.014	+0.052	+0.003	+0.069
Limnephilidae	0.5	-0.003	-0.005	-0.003	+0.005	-0.005	-0.005	-0.005
Lepidostomatidae	0.0	+0.002	0.0	0.0	0.0	+0.001	0.0	0.0
Leptoceridae	1.4	-0.004	-0.014	+0.018	-0.011	-0.009	+0.011	-0.014
Phryganeidae	0.0	+0.002	0.0	+0.001	+0.003	0.0	0.0	+0.064
Hydropsychidae	0.0	+0.002	0.0	0.0	0.0	0.0	0.0	0.0
EPHEMEROPTERA								
Baetidae	0.5	+0.167	+0.393	+0.007	+0.393	-0.002	+0.259	-0.005
Tricorythidae	0.7	-0.005	-0.003	-0.007	-0.003	0.0	-0.007	-0.007
ODONATA	0.1	+0.095	+0.132	+0.090	+0.132	+0.009	+0.144	-0.001
COLEOPTERA								
Elmidae	3.3	-0.002	-0.033	-0.032	-0.033	+0.045	+0.159	-0.033
Chrysomelidae	0.01	+0.011	-0.0001	+0.044	-0.0001	-0.0001	-0.0001	-0.0001
HYDRACARINA	1.6	+0.132	+0.029	-0.015	+0.029	+0.005	-0.016	+0.045
LEPIDOTERA	0.0	+0.002	0.0	+0.001	0.0	0.0	0.0	0.0
DIPTERA								
Chironomidae larvae	28.9	-0.204	-0.125	+0.296	-0.125	+0.241	-0.089	-0.289
Chironomidae pupae	1.8	+0.086	+0.138	+0.116	+0.138	+0.014	+0.113	+0.288
Tipulidae	0.7	-0.005	-0.007	-0.006	-0.007	+0.001	-0.007	+0.057
Ceratopogonidae	2.5	-0.021	-0.021	-0.024	-0.025	-0.023	-0.025	-0.025
Muscidae	0.0	+0.002	+0.004	0.0	+0.004	+0.003	0.0	0.0
Simuliidae	0.02	+0.002	+0.004	+0.004	+0.004	-0.0002	-0.0002	-0.0002
Chaoboridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	0.02	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
AMPHIPODA	2.1	+0.052	+0.016	-0.020	+0.016	+0.003	-0.021	-0.021
GASTROPODA								
Planorbidae	5.6	+0.015	-0.042	-0.029	-0.042	+0.017	-0.028	+0.011
Lymnaeidae	0.5	-0.003	-0.001	-0.001	-0.001	+0.002	-0.005	-0.005
OLIGOCHAETA	35.6	-0.344	-0.346	-0.345	-0.346	-0.336	-0.346	-0.184
NEMATODA	2.9	-0.027	-0.029	-0.028	-0.029	+0.005	-0.029	+0.093
OSTRACODA	1.7	+0.089	-0.013	-0.016	-0.013	+0.078	-0.017	-0.017
PLANARIDAE	1.6	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016
BIVALVE								
Sphaeriidae	6.3	-0.057	-0.036	-0.062	-0.036	-0.060	-0.063	-0.063

[1][%] is the percent composition in benthic macroinvertebrate dredges.

for Ostracoda (+0.401) and Hydracarina (+0.072). Planorbidae and Lymnaeidae had the highest electivity for peamouth at +0.698 and +0.178, respectively. Northern squawfish showed highest prey selection for Nematoda (+0.300) and Chironomidae larvae (+0.279). Largescale suckers had highest electivity for Ceratopogonidae (+0.180) and Sphaeriidae (+0.158). For longnose sucker, highest electivity was for Ostracoda (+0.778).

3.6.10 DIET OVERLAPS

Table 3.172 provides information on the extent of diet overlap between the major fish species in the Pend Oreille River. High overlaps (≥0.7) were between; yellow perch and black crappie (0.865), mountain whitefish and pumpkinseed (0.832), mountain whitefish and brown bullhead (0.895) and pumpkinseed and brown bullhead (0.868). Medium range overlaps between fish (≥0.5) were common in the Pend Oreille River. Brown bullhead overlapped with other species more frequently than any other member of the fish community.

Table 3.173 shows the extent of diet overlap between largemouth bass year classes and other fish species. Yellow perch overlapped with 0+ largemouth bass (0.735), 1+ largemouth bass (0.844) and 2+ largemouth bass (0.635). Black crappie overlapped with 0+ largemouth bass (0.689) and 1+ largemouth bass (0.688). Brown trout showed overlap with 2+ largemouth bass (0.656) and 3+ largemouth bass (0.625). Largemouth bass 4+ and older had very low overlaps with other fish, with the exception of one mid range overlap with northern squawfish at 0.546.

3.7 FISH MOVEMENT AND MIGRATION

Three brown trout recaptures had changed location from the time they were tagged to the time they were recaptured (Table 3.174). Two of these moved from the river at study site 8 into the adjacent tributary mouth (site 8A). The other brown trout was tagged **at site 3A in July, recaptured at 3A in September, and** recaptured again, 11 km away, at site 8A in October.

Of the 4 mountain whitefish that moved, all moved from the river site where they were tagged into an adjacent tributary mouth. Three mountain whitefish tagged in March at site 3 were subsequently recaptured at site 3A in August and September. One

Table 3.171. Prey selection (electivity) for benthic macroinvertebrates by non-target fish species for 1988, Pend Oreille River, WA.

ORGANISMS	%[1]	Brown bullhead	Tench	Peamouth	Northern squawfish	Lrgscale sucker	Longnose sucker
		N=10	N=7	N=2	N=12	N=3	N=3
TRICHOPTERA							
Hydroptilidae	1.1	-0.011	0.0	-0.011	-0.011	-0.011	-0.011
Limnephilidae	0.5	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Lepidostomatidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptoceridae	1.4	-0.013	-0.014	-0.014	-0.014	-0.014	-0.014
Phryganeidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hydropsychidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EPHEMEROPTERA							
Baetidae	0.5	-0.004	-0.334	-0.005	-0.005	-0.005	-0.005
Ephemerillidae	0.1	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Tricorythidae	0.7	-0.007	-0.007	-0.007	-0.007	-0.007	-0.0007
ODONATA	0.1	-0.001	-0.001	-0.001	-0.001	+0.01	-0.001
COLEOPTERA							
Elmidae	3.3	-0.033	-0.033	-0.033	-0.033	-0.033	-0.033
Chrysomelidae	0.01	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
HYDRACARINA	1.6	-0.01	+0.072	-0.016	-0.016	-0.016	-0.01
LEPIDOTERA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DIPTERA							
Chironomidae larvae	28.9	+0.661	-0.026	-0.289	+0.279	-0.031	-0.171
Chironomidae pupae	1.8	-0.014	-0.018	-0.018	-0.018	+0.014	-0.01
Tipulidae	0.7	-0.007	-0.007	-0.007	-0.007	+0.004	-0.001
Ceratopogonidae	2.5	-0.002	+0.041	-0.025	-0.025	+0.180	-0.002
Muscidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Simuliidae	0.02	-0.0022	-0.0002	-0.0002	-0.0002	-0.0002	-0.002
Chaoboridae	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tabanidae	0.02	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
AMPHIPODA	2.1	-0.017	-0.021	-0.021	-0.021	+0.053	-0.021
GASTROPODA							
Planorbidae	5.6	-0.039	-0.056	+0.698	-0.043	-0.056	-0.013
Lymnaeidae	0.5	-0.004	-0.005	+0.178	-0.005	-0.005	-0.005
OLIGOCHAETA	35.6	-0.346	-0.346	-0.346	-0.333	-0.304	-0.346
NEMATODA	2.9	-0.028	-0.029	+0.027	+0.300	-0.018	-0.029
OSTRACODA	1.7	-0.009	+0.401	-0.017	-0.017	+0.109	+0.778
PLANARIDAE	1.6	-0.016	-0.016	-0.016	-0.016	-0.016	-0.016
BIVALVE							
Sphaeriidae	6.3	-0.061	-0.052	-0.055	-0.05	+0.158	-0.06

[1][%] is the percent composition in benthic macroinvertebrate dredger.

Table 3.172. **Annual diet overlaps between fish species based on relative importance values for 1988, Pend Oreille River, WA.**

	Yellow perch	Lrgmouth bass	Mountain whitefish	Black crappie	Pumpkin-seed	Brown trout	Cutthroat trout	Brown bullhead	Tench	Peamouth	Northern squawfish	Lrgscale sucker	Longnose sucker
	N=565	N=321	N=208	N=103	N=53	N=28	N=8	N=10	N=7	N=2	N=12	N=3	N=3
Yellow perch	1.0	0.391	0.285	0.865	0.499	0.327	0.038	0.343	0.556	0.057	0.105	0.468	0.451
Largemouth bass		1.0	0.144	0.342	0.350	0.303	0.083	0.136	0.223	0.013	0.558	0.165	0.122
Mountain whitefish			1.0	0.354	0.832	0.419	0.156	0.895	0.427	0.041	0.524	0.483	0.514
Black crappie				1.0	0.465	0.306	0.057	0.390	0.351	0.00	0.134	0.595	0.284
Pumpkinseed					1.0	0.442	0.152	0.868	0.560	0.136	0.489	0.110	0.675
Brown trout						1.0	0.561	0.357	0.284	0.028	0.217	0.199	0.226
Cutthroat trout							1.0	0.130	0.055	0.029	0.100	0.069	0.078
Brown bullhead								1.0	0.503	0.179	0.547	0.559	0.660
Tench									1.0	0.215	0.228	0.488	0.676
Peamouth										1.0	0.156	0.278	0.146
Northern squawfish											1.0	0.367	0.300
Largescale sucker												1.0	0.426
Longnose sucker													1.0

Table 3.173. Annual diet overlaps between largemouth bass year classes and other fish species based on relative importance values for 1988, Pend Oreille River, WA.

	Yellow perch	Mountain whitefish	Black crappie	Pumpkin-seed	Brown trout	Cutthroat trout	Brown bullhead	Tench	Peamouth	Northern squawfish	Lrgscale sucker	Longnose sucker
	N=565	N=208	N=103	N=53	N=28	N=8	N=10	N=7	N=2	N=12	N=3	N=3
0+ Largemouth bass N=17	0.735	0.258	0.689	0.326	0.489	0.049	0.290	0.433	0.000	0.089	0.329	0.200
1+ Largemouth bass N=70	0.844	0.294	0.688	0.441	0.404	0.086	0.305	0.581	0.000	0.228	0.323	0.317
2+ Largemouth bass N=57	0.635	0.267	0.509	0.330	0.656	0.156	0.241	0.480	0.000	0.116	0.181	0.241
3+ Largemouth bass N=119	0.504	0.262	0.436	0.299	0.625	0.211	0.229	0.342	0.000	0.359	0.220	0.184
≥4+ Largemouth bass N=58	0.073	0.063	0.058	0.049	0.143	0.045	0.048	0.040	0.023	0.546	0.042	0.040

mountain whitefish was caught and tagged at site 8 in May and recaptured at 8A in September.

Ten largemouth bass were found to have moved between being tagged and recaptured. Two were tagged in May, 1985 at site 5A, one was recaptured in April, 1988 at 4B and the other was recaptured at site 5 in May, 1988. One bass was tagged at site 3 in April and captured 17 km downstream, at site 2, in July. The only other bass movement of any distance was approximately 14 km from site 3C to site 9A between May and August.

Four tench were recaptured in a location other than where they were tagged. All were captured near their original tagging location with the furthest movement being just over 4 km from site 5 to site 4A. Of the three pumpkinseeds that moved, only one covered much distance, moving approximately 9 km from site 3 to site 7. One longnose sucker moved from site 3 to site 4A (1.6 km). One largescale sucker move from site 9 to site 3A (approximately 14 km) between September, 1987 and May, 1988. Three northern squawfish were captured at sites other than where they were tagged. One moved approximately 14 km from site 3 upstream to site 9. The other 2 moved about 31 km downstream from site 1 to site 2.

Table 3.175 shows the location and date of tagging for tagged fish caught by anglers. Three of the tagged bass caught by anglers had changed locations. One moved about 13 km from site 4B to site 9A between April and May. The other two bass made small moves. The greatest distance covered by any fish was the approximately 80 km by a 250 mm cutthroat trout from site 1 in May to site 11 in June.

The tagging and recapture dates and locations for all fish recaptured in months other than the month when they were tagged, can be found in Appendix I.

3.8 HABITAT UTILIZATION

The habitat utilization measurements for the parameters depth, velocity, substrate, and cover can be found in Appendix J. This data will be collected over the entire three years of the study in order to collect enough data to construct Habitat Suitability Indices.

Table 3.174. Date and location of tagging and recapture for fish recaptured in locations other than where they were tagged.

Location Tagged	Month Tagged	Species	Age	Month Recaptured	Recaptured Location
3A	JUL-88	Brown trout	6 +	OCT-88	8A
8	JUL-88	Brown trout	7 +	AUG-88	8A
8	OCT-88	Brown trout	7 +	OCT-88	8A
3	MAR-88	Mountain whitefish	3 +	AUG-88	3A
3	MAR-88	Mountain whitefish	3 +	AUG-88	3A
3	MAR-88	Mountain whitefish	3 +	SEP-88	3A
8	MAY-88	Mountain whitefish	3 +	SEP-88	8A
5A	MAY-85	Largemouth bass	11 +	APR-88	4B
5A	MAY-85	Largemouth bass	11 +	MAY-88	5
5A	MAR-88	Largemouth bass	5 +	MAY-88	4A
5	MAY-88	Largemouth bass	11 +	JUN-88	5A
3	APR-88	Largemouth bass	6 +	JUL-88	2
3c	MAY-88	Largemouth bass	6 +	AUG-88	9A
4A	MAY-88	Largemouth bass	6 +	AUG-88	3A
5B	MAR-88	Largemouth bass	9 +	SEP-88	8C
5	APR-88	Largemouth bass	11 +	OCT-88	4A
4A	.	Largemouth bass	3 +	OCT-88	7
3	OCT-87	Tench	6 +	MAY-88	3A
4A	OCT-87	Tench	7 +	MAY-88	3A
5	SEP-87	Tench	7 +	MAY-88	5B
5	•	Tench	6 +	APR-88	4A
3	•	Pumpkinseed	4 +	JUN-88	4
4	•	Pumpkinseed	4 +	JUL-88	4A
3	*	Pumpkinseed	5 +	OCT-88	7
3	•	Longnose sucker	4 +	APR-88	4A
9	SEP-87	Largescale sucke	8 +	MAY-88	3A
4	*	Largescale sucke	8 +	OCT-88	3A
3	•	Northern squawfis,	4 +	OCT-88	9
1	•	Northern squawfis	4 +	OCT-88	2
1	.	Northern squawfis	4 +	OCT-88	2

• Denotes that fish were tagged with a non-numbered Floy FD-67F anchor tag therefore tagging date was unknown.

Table 3.175. Date and location of tagging and recapture for fish caught by anglers.

Location Tagged	Month Tagged	Species	Age	Month Recaptured	Recapture Location
5A	MAY-85	Largemouth bass	10+	APR-88	4B
5B	MAY-85	Largemouth bass	13+	MAY-88	5B
8C	MAR-88	Largemouth bass	5+	MAY-88	8C
4B	APR-88	Largemouth bass	8+	MAY-88	9B
5A	MAY-88	Larqemouth bass	7+	MAY-88	5B
5B	MAY-88	Largemouth bass	5+	JUN-88	5B
4A	MAY-88	Largemouth bass	7+	JUN-88	4A
1	JUL-88	Largemouth bass	6+	JUL-88	1
1	MAY-88	Cutthroat trout	2+	JUN-88	11B
3D	MAY-88	Brook trout	2+	JUN-88	3D
3D	MAY-88	Brook trout	2+	JUL-88	3D
2	APR-88	Mountain whitefish	3+	JUL-88	2
2	APR-88	Mountain whitefish	4+	JUL-88	2
2	MAR-88	Mountain whitefish	3+	JUL-88	2

3.9 CREEL SURVEY

3.9.1 ANGLER PRESSURE, CATCH PER UNIT EFFORT (CPUE), TOTAL CATCH, AND HARVEST ESTIMATES

The annual pressure estimate for boat anglers was 2,289 ± 206 angler hours. Shore anglers had less pressure at 1,850 ± 261 angler hours. During 1988, an estimated 4,139 ± 467 hours of fishing occurred in Box Canyon Reservoir. Pressure estimates for each strata are listed in Appendix K.1.

Results for annual estimates of catch per unit effort (CPUE), total catch, and harvest ± 95% confidence intervals are listed in Table 3.176. CPUE for all fish (kept and released) was 2.06 fish/hour for boat anglers and 2.90 fish/hour for shore anglers. Total catch (kept and released fish) for boat anglers was 4,722 ± 424 fish. Largemouth bass made up the largest proportion of the catch at 3,205 ± 288 fish, followed by yellow perch (973 ± 88), pumpkinseed (256 ± 23) and northern squawfish (222 ± 20). Shore angler total catch was 5,360 ± 757 fish. Yellow perch were the largest proportion of the shore angler catch at 3,546 ± 500 individuals, followed by brown bullhead (549 ± 77), pumpkinseed (501 ± 71), and largemouth bass (229 ± 32). The total catch for 1988 was 10,082 ± 1,181 fish.

Harvest estimates were based on kept fish checked during angler interviews. CPUE for harvested fish by boaters was 0.34 fish /hour (Table 3.176). CPUE for shore anglers harvest was 0.93 fish/hour. Total harvest (± 95% confidence limits) for boaters was 783 ± 69 individuals, consisting of 426 ± 38 yellow perch, 291 ± 26 largemouth bass, and 34 ± 3 black crappie. Shore anglers harvested a total of 1,722 ± 243 fish, consisting of 842 ± 119 yellow perch, 314 ± 44 brown bullhead, 278 ± 39 pumpkinseed, 98 ± 14 largemouth bass, 75 ± 11 mountain whitefish, and 70 ± 10 cutthroat trout. The total harvest was estimated at 2,505 ± 312 fish.

Fig. 3.7 shows the seasonal trends in angler pressure (angler hours) from March to December, 1988. Peaks in angler pressure occurred during July, at 1,676 angler hours. August had the next highest pressure at 918 angler hours, followed by April at 726 angler hours. After September angler pressure was very low, at 87 angler hours in October, 7 angler hours in November, and 1 angler hour during December.

Table 3.176. Annual estimates for total catch (including fish released) and total harvest (± 95% C.I.) for the Pend Oreille River (March-December, 1988).

	TOTAL CATCH			HARVEST		
	BOAT ANGLERS	SHORE ANGLERS	TOTAL	BOAT ANGLERS	SHORE ANGLERS	TOTAL
Catch Rate (CPUE) (Fish/Hour)	2.06	2.90	2.44	0.34	0.93	0.61
Largemouth Bass	3205±288	229±32	3434±320	291±26	98±14	389±40
Yellow Perch	973±88	3546±500	4519±588	426±38	842±119	1268±157
Black Crappie	34±3	35±5	69±8	34±3	7±1	41±4
Brown Trout	16±1	20±3	36±4	16±1	20±3	36±4
Cutthroat Trout	16±1	75±11	91±12	16±1	70±10	86±11
Rainbow Trout		20±3	20±3		20±2	20±2
Mountain Whitefish		146±21	146±21		75±11	75±11
Pumpkinseed	256±23	501±71	757±94		278±39	278±39
Brown Bullhead		549±77	549±77		312±44	312±44
Sucker		28±4	28±4			
Northern Squawfish	222±20	189±27	411 ±47			
Peamouth		15±2	15±2			
Tench		7±1	7±1			
TOTAL	**4722±424**	**5360±757**	**10,082±1181**	**783±69**	**1722±243**	**2505±312**

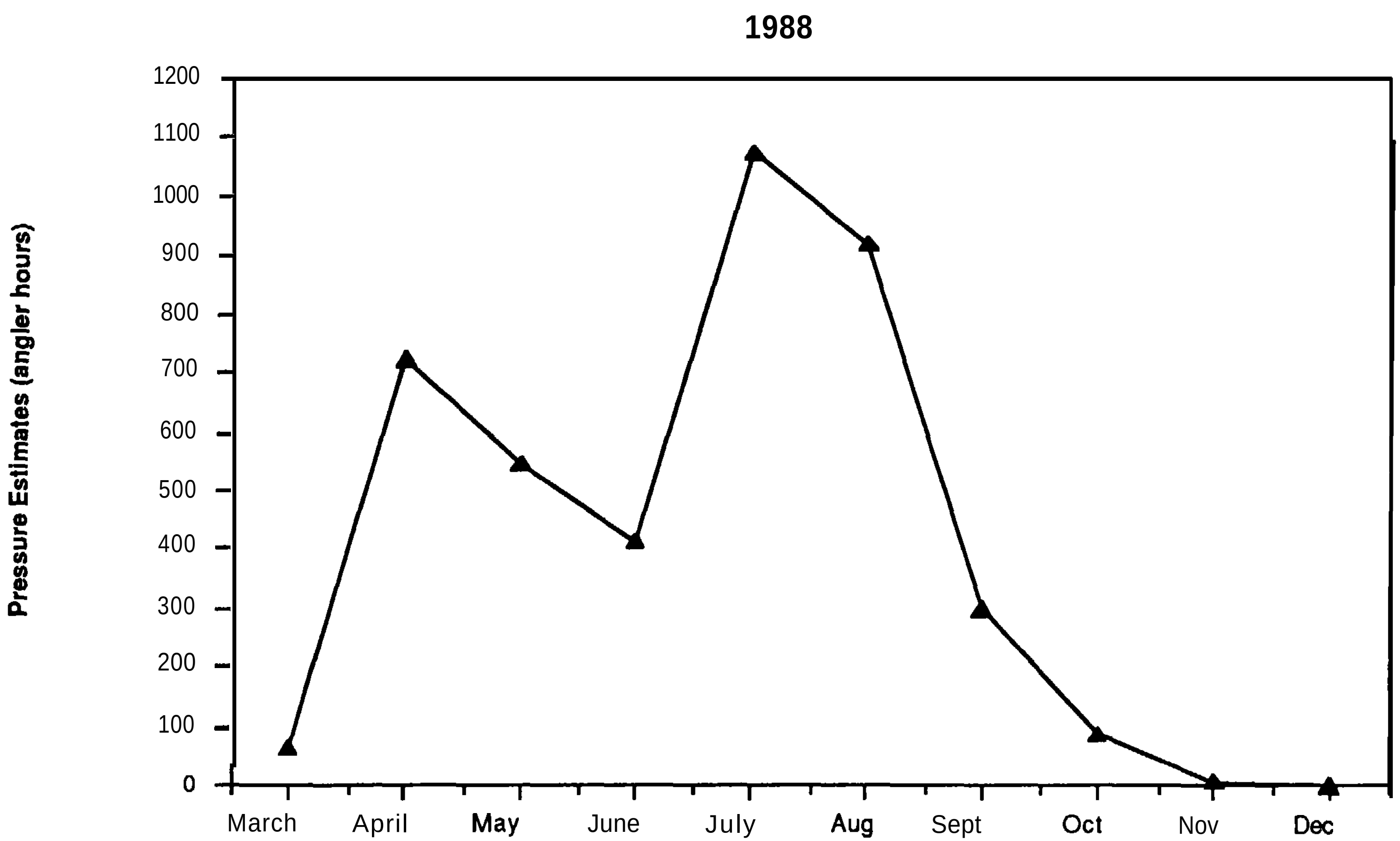

Fig. 3.7. Seasonal trends in angler pressure (angler hours) on the Pend Oreille River from March to December, 1988.

3.9.2 ANGLER PREFERENCE

Angler preferences for fish species by both shore and boat anglers are listed in Table 3.177. During March, 18 shore anglers were interviewed. Of these fishermen, 61.1 percent had no preference, 33.3 percent fished for trout and 5.6 percent fished for whitefish. In April, 75 shore anglers and 15 boat anglers were interviewed. For shore anglers, 44.7 percent had no preference, 30.7 percent fished for trout, and 13.3 percent fished for largemouth bass. Boat anglers in April were predominantly after largemouth bass (66.7%) and trout species (20.0%). During May, 16 shore anglers and 6 boat anglers were interviewed. Shore anglers preferred trout (43.8%), followed by no preference (43.8%) and black crappie (12.5%). Boat angler preference in May was for largemouth bass (83.3%) and 16.7 percent had no preference. In June, 42 shore anglers and 15 boat anglers were interviewed. Highest shore angler preference was for no preference (54.8%), followed by largemouth bass (33.3%). Boat anglers in June were after largemouth bass at 46.7%. Thirty-three percent had no preference and 20.0% fished for black crappie. In July, 35 shore anglers and 7 boat anglers were interviewed. For shore anglers, 77.1 percent had no preference and 20 percent were fishing for trout. Boaters were fishing predominantly for largemouth bass (42.8%) and trout (28.6%) in July. During August, 20 shore anglers and 3 boat anglers were interviewed. For shore anglers 55.0 percent were fishing for trout and 45.0 percent had no preference. Most boat anglers in August had no preference (66.6%), however 33.3 percent were fishing for largemouth bass.

From September to December, the number of angler interviews was minimal, due to decreased angler pressure during this time, During this period, most shore anglers had no specific fishing preference, at 83.3 percent in September, 45.4 percent in October, and 100 percent in December. Boat anglers that were interviewed during this time where fishing exclusively for trout.

Results of angler preferences for different locations on the Box Canyon Reservoir are listed in Appendix K.

3.9.3 BASS TOURNAMENT RESULTS

Table 3.178 summarizes bass tournament angling success on the Pend Oreille River, from 1984 to 1988 (WDW files; UCUT files). Catch rates (CPUE for weighed-in fish) for bass tournament anglers ranged from 0.154 fish/hour in May 1986 to a high of 0.221

Table 3.177. Angler preference for fish species in Pend Oreille River.

	March	April	May	June	July	August	September	October	November	December
SHORE ANGLERS	N=18	N=75	N=16	N=42	N=35	N=20	N=6	N=11	None	N=1
No preference	61.1	44.4	43.8	54.8	77.1	45.0	83.3	45.4		100.0
Largemouth Bass		13.3		33.3	2.8					
Trout	33.3	30.7	43.8	7.1	20.0	55.0	16.7	36.4		
Mountain Whitefish	5.6	2.7								
Yellow Perch		4.0								
Black Crappie		1.3	12.5	4.8				18.2		
Brown Bullhead		4.0								
BOAT ANGLERS	None	N=15	N=6	N=15	N=7	N=3	N=1	None	N=1	None
No preference		13.3	16.7	33.3	28.6	66.6				
Largemouth Bass		66.7	83.3	46.7	42.8	33.3				
Trout		20.0			28.6		100.0		100.0	
Mountain Whitefish										
Yellow Perch										
Black Crappie				20.0						
Brown Bullhead										

Table 3.178. Summary of bass tournament results.

Date	Angler hours	CPUE (kept-released) Fish/hour	CPUE (kept-weighed-in) Fish/hout	Mean (weight)	Weight range (lbs)
6/23-6/24/84	- - -	- - -	- - -	1.6	- - -
6/15-6/16/85	380	- - -	0.189	1.8	0.8-4.6
5/17-5/18/86	- - -	- - -	0.154	1.8	- - -
5/14-5/15/88	828	0.283	0.221	1.9	1.0-5.9
8/27/88	144	0.201	0.160	3.2	1.2-6.7

fish/hour in May 1988. Largemouth bass have shown a gradual increase in mean weight, ranging from a low of 1.6 Ibs in 1984 to a high of 3.2 Ibs in 1988.

Comments by tournament anglers indicate that fishing was good to excellent. Anglers were especially impressed by the size of bass caught. Members of the Tamarack Bass Busters in June 1985 commented on their final tournament report to the Department of Game that, *"fluctuating water levels on the reservoir made fishing* success *drop considerably* at *times."* During the spring of 1988, two bass tournaments were cancelled due to low water levels caused by an equipment malfunction at Box Canyon Dam.

4.0 DISCUSSION

The time period covered by this report was atypical in two respects: (1) it was an abnormally low flow year; and (2) the gates at Box Canyon Dam were left open from May 19 to June 2, resulting in a drop in the water level in excess of 20 feet at lone and a 6 to 8 foot drop at Cusick. These events have impacted the data collected in this study, however, to what degree it is impossible to assess at this point. Hopefully, the next two years will be more typical to allow comparisons to be made between low water years and normal years.

4.1 RELATIVE ABUNDANCE

The abundance of yellow perch and pumpkinseeds in the Pend Oreille River can be explained by the abundance of littoral habitat with macrophytes for spawning and cover. Yellow perch are most often associated with pools and slack water with greater than 20 percent of the area containing aquatic vegetation (Krieger et *al.* 1983). Pumpkinseed are also frequently associated with slack water and a bottom substrate containing organic debris and aquatic macrop hytes (Carlander 1977). Along with ideal habitat the lack of an abundant predator contributes to the abundance of yellow perch and pumpkinseeds. Largemouth bass, northern squawfish, and brown trout (the primary piscivorous fish in the Pend Oreille River) combined made up only 13.1 percent of the fish caught by electrofishing (Table 3.3). This includes all age classes so the percent of the population that is piscivorous would be even lower.

While the microhabitat of the Pend Oreille River appears to be suitable for largemouth bass with slow moving water, a soft bottom, and aquatic macrophytes, largemouth bass are not very abundant, making up only 7.1 percent fish captured electrofishing (Table 3.3). Optimum water temperatures for the growth of adult largemouth bass ranges from 24-30° C, embryo survival is optimized at 20-21° C, and fry growth is optimized at 27-30° C (Stuber et al. 1982). Water temperatures in the Pend Oreille River tend to be lower than these optimal temperatures. The maximum water temperatures recorded during this study were found in August. A water temperature of 25° C was measured in a slough and 23” C was the maximum water temperature recorded in the river. Water temperatures, therefor, are rarely optimal for the growth and survival of largemouth bass and cool water temperatures may reduce embryo survival and limit growth for fry, juvenile, and adult largemouth bass. Another factor that may limit largemouth bass populations in the Pend Oreille are water level fluctuations during late May and June when bass spawning occurs. Male largemouth bass, on the average, construct nests at depths of 0.3 to 0.9 m (Stuber et *al.* 1982) so they are extremely susceptible to water level fluctuations.

On May 19, a crane used to operate the gates at Box Canyon Dam malfunctioned resulting in the gates at the dam being left open. Water levels in the reservoir dropped more than 20 feet near lone and 6 to 8 feet near Cusick before the crane was repaired and the gates closed on June 2. Cusick is in the area where most of the sloughs are located and the drawdown dewatered a large area of the sloughs that are most frequently used by bass for spawning. The impact this had on the bass population was hard to assess. However, during the drawdown a large number of the female largemouth bass captured near the mouths of sloughs were spent and many of the males had eroded caudal fins from fanning a nest. Fortunately, many bass spawned in June after the gates were closed and the water levels rose as evidenced by the presence of large numbers of bass larvae in the sloughs in June. Since largemouth bass nests are highly susceptible to water level fluctuations, especially declining water levels, water level fluctuations in the reservoir should be kept to a minimum.

Salmonids were also rare in fisheries surveys. Mountain whitefish were the most abundant salmonid making up 4.3 percent of the catch in electrofishing surveys (Table 3.3) and 4.5 percent in gill net surveys (Table 3.5). All trout combined, made up 0.7 percent of the total catch, with brown trout accounting for 0.6 percent of the total catch. Trout were only slightly more abundant in the gill nets making up 2.3 percent of the catch. The small population of trout can be attributed to the lack of physical diversity of habitat in the river. Trout habitat in lotic environments is optimized when there is roughly a 1:1 pool to riffle ratio (Raleigh et al.1 984, Raleigh et a/.1986). The Pend Oreille River between Albeni Falls and Box Canyon Dams contains no riffle habitat and most of the river resembles a sluggish run which provides little trout habitat.

Trout and whitefish in the reservoir were mainly captured in the areas in and around the tributary mouths. Mountain whitefish were more abundant in the riverine areas near LeClerc Creek and Kelly Island, near Newport,

4.2 POPULATION ESTIMATES

4.2.1 TRIBUTARIES

When using the Petersen estimate, several assumptions must be met to insure the accuracy of the estimate. Biological assumptions include: (1) marked fish had the same mortality rate as unmarked fish; (2) marks were not lost during the period between marking and recapture; (3) marked fish were caught at same rate as unmarked fish; (4) marked fish were randomly distributed or the sampling effort was random; (5) recruitment was negligible or could be estimated; and (6) capture and recapture effort is uniform (Ricker 1975, Everhart and Youngs 1981). Mathematical assumptions that must be met are: (1) the number of recaptures (r) must be ≥ 7; and (2) the product of m x C must exceed 4 x N (Robson and Regier 1964).

The first biological assumption was believed to have been met. During the initial tagging, fish were not marked if it was questionable that they would survive. During the recapture, no dead fish were found within the study areas. Scholz et *al.* (1988) tested the assumption that brown trout and rainbow trout with fin clips did not suffer higher mortality rates than did unclipped fish. No mortality occurred in either group during the 14 day test.

The assumption that marks were not lost between the marking and recapture periods was met. The maximum time period between marking and recapture was three days and it is impossible for a fish to regenerate a fin in three days. The third and fourth assumptions were met by using electrofishing, which is an active capture technique that randomly samples the fish population. spot electrofishing was employed to reduce the possibility that fish would avoid the weaker electrical current at the edge of the field and move ahead of the shocker.

The fifth biological assumption that immigration and emigration were negligible was believed to be met due to a maximum time between sample periods of three days. It is possible that some fish moved into or out of the sample reaches between sample periods, however, trout generally stay in the same general location except when spawning. The sixth assumption was met by using the same electrofishing crew during marking and recapture and by keeping the shocking times in each sample period as close as possible.

In general, all mathematical assumptions were met for all tributaries where there was a significant population of a particular species (i.e., brown trout and brook trout). Cutthroat trout population estimates, typically, did not meet the mathematical assumptions due to their low densities in the tributaries.

The first mathematical assumption, that there is a minimum of seven recaptures, was violated for cutthroat trout in Skookum, Cee Cee Ah, and Tacoma Creeks, and for brook trout in Tacoma Creek. Ricker (1975) noted that with 3-4 recaptures statistical bias can be ignored. This criteria was met for all but cutthroat trout in Skookum and Tacoma Creeks. The second mathematical assumption, that m x C is greater than 4 x N, was not met for cutthroat trout in Skookum and Tacoma Creeks.

The three assumptions that should be met for the removal-depletion estimate are: (1) no fish can move in or out of the sample area; (2) each fish has an equal chance of being captured; and (3) the probability of capture is constant over all removal occasions.

These assumptions were met by (1) placing block nets at the upstream and downstream ends of the study site to prevent fish moving into and out of the study area; (2) keeping the shocking time as close as possible on each pass; and (3) keeping the same crew for each pass to insure consistency in effort between passes.

Cee Cee Ah Creek had the largest brown trout population of the five creeks sampled with 536 brown trout/800 yards (Table 4.1). Skookum Creek, which is about the same size as Cee Cee Ah Creek at base flow, had an estimated population of 451 brown trout/800 yards. The West Branch of LeClerc Creek, which is about twice as large as Cee Cee Ah and Skookum Creeks, contained an estimated 34 brown trout/800 yards.

Tacoma Creek, the largest of the five tributaries sampled, contained an estimated 2,009 brook trout/800 yards however, the confidence interval was quite large because of the low number of recaptures (Table 4.1). Ruby Creek, the smallest of the tributaries sampled, was estimated to contain 995 brook trout/800 yards. Skookum, Cee Cee Ah, and LeClerc Creeks followed with 583, 430, and 29 brook trout/800 yards, respectively.

Table 4.1. Population estimates and 95 percent confidence intervals/800 yards for trout populations in Pend Oteille Rivet tributaries.

Brown Trout	**Est. Pop. ± 95 % C.I.**
Cee Cee Ah Creek	536 ± 161
Skookum Creek	451 ± 195
LeClerc Creek	34 ± 6
Brook Trout	
Tacoma Creek	2,009 ± 1,672
Ruby Creek	995 ± 252
Skookum Creek	583 ± 230
Cee Cee Ah Creek	430 ± 121
LeClerc Creek	29 ± 2
Cutthroat Trout	
Tacoma Creek	90 ± 156
Ruby Creek	64
Cee Cee Ah Creek	42 ± 28
Skookum Creek	2 ± 1
LeClerc	2 ± 0

Cutthroat trout were rare in all tributaries sampled (Table 4.1). Tacoma Creek had the highest estimate for cutthroat trout with 90/800 yards, followed by Ruby Creek with 64/800 yards, Cee Cee Ah Creek with 42/800 yards, and Skookum and LeClerc Creeks with 2/800 yards.

Trout populations were estimated in May except for Ruby Creek which was estimated in July. The major problem involved with the May sampling period was that flows were higher than that which would be optimal for conducting population estimates using a backpack electrofisher. Conductivities in all of the tributaries except Skookum Creek were low, making electrofishing less effective. An additional problem with doing spring population estimates is that young-of-the-year fish have not emerged or are too small to capture using electrofishing. Population estimates in 1989 and 1990 will be conducted in the fall when water levels are lower and young-of-the-year fish are large enough to capture.

4.2.2 RIVER AND SLOUGHS

Ricker (1975) noted that a minimum of four recaptures is required to estimate populations using a multiple census method. This was met for all estimates except black crappie, for which there was only one recapture and for mountain whitefish at site 2 where there were only two recaptures. Ricker (1975) also stated that there should be “approximately” no recruitment and mortality during the census period. There was no way to determine mortality during this census. Recruitment of young-of-the-year fish was eliminated by estimating the population for one year and older fish. It was possible to determine whether immigration and emigration was occurring because fish at each study site were given a site specific or numbered tag. Two of the pumpkinseed recaptures were recaptured at a site other than where they were tagged, one tench had moved, one longnose sucker had moved, one largescale sucker moved, three northern squawfish moved, and seven largemouth bass had moved.

The movement of fish caused some difficulty in the expansion of the population estimates for the entire reservoir. If no movement of tagged fish had occurred, then the estimates for the sample sites could be expanded for the entire reservoir as was the case for yellow perch and mountain whitefish. If the tagged fish were found to be randomly distributed in the reservoir, then the population estimate would be for the entire reservoir. This was not the case for any species. Since, in this study, a few individuals of some species were found to move the population estimates for these species may overestimate the actual population size.

The confidence limits were large for all population estimates due to the low numbers of recaptures in relation to the number of fish sampled. To help evaluate the accuracy of the population estimates, the proportion of the sum of all estimates that each species estimate accounted for was compared with the percent composition of each species in the electrofishing relative abundance (Table 4.2). While the proportions in Table 4.2 were not equal, they were relatively close. Part of this difference was because the population estimates were made for one year and older fish while the relative abundance information included young-of-the-year fish. Within the confines of the confidence limits, it is felt that the population estimates are reasonably accurate and are useful from a management perspective.

4.3 AGE, GROWTH, AND CONDITION

4.3.1 TRIBUTARIES

4.3.1 .1 BROWN TROUT

Back-calculated lengths for brown trout in Pend Oreille tributaries tend to be smaller at the formation of each annulus than those for other streams in the Pacific Northwest (Table 4.3).

4.3.1.2 BROOK TROUT

Brook trout lengths in Pend Oreille tributaries are larger than in other streams in the Pacific Northwest at the end of the third year of growth (Table 4.4).

4.3.1.3 CUTTHROAT TROUT

Back-calculated lengths of cutthroat trout in Pend Oreille **River tributaries are larger than those from other streams in the** Pacific Northwest (Table 4.5).

Table 4.2. Comparison of the percent composition for each species from population estimates and electrofishing relative abundance.

Species	Percent Composition from population estimates	Percent Composition from electrofishing relative abundance
Yellow perch	62.9	42.1
Pumpkinseed	25.3	19.0
Tench	6.4	9.6
Largescale sucker	1.2	4.8
Longnose sucker	1.2	3.6
Largemouth bass	1.0	7.2
Northern squawfish	0.9	5.3
Black crappie	0.9	1.3
Mountain whitefish	0.2	4.3

Table 4.3. Comparison of average back-calculated lengths at annulus for Pend Oreille River tributary brown trout with other streams in the region.

	LENGTH AT ANNULUS FORMATION					
	1	2	3	4	5	6
East River, Priest River Drainage (Homer et al. 1987)	80	118	138	- -	- -	- -
Chamokane Creek, WA (Uehara et *al. 1988)*	104	195	285	373	424	686
Little Deschutes River, OR (Lorz 1974)	76	124	172	219	287	357
Browns Creek, OR (Lorz 1974)	102	190	296	397	469	517
Cranes Creek, ID (Corsi 1984)	127	243	348	412	446	- -
Lower Willow Creek, ID (Corsi 1984)	100	271	255	334	402	459
Robinson Creek, ID (Brostrum and Spateholts 1985)	107	171	245	295	318	321
Wyoming Creek, ID (Brostrum and Spateholts 1985)	115	212	269	- -	- -	- -
Skookum Creek (present study)	80	132	192	264	- -	- -
Cee Cee Ah Creek (present study)	81	135	198	251	- -	- -
Tacoma Creek (present study)	93	164	212	- -	- -	- -
LeClerc Creek (present study)	78	141	206	271	- -	- -

Table 4.4. Comparison of average back-calculated lengths at annulus for Pend Oreille River tributary brook trout with other streams in the region

	LENGTH AT ANNULUS FORMATION		
	1	2	3
East River, Priest River Drainage (Horner et *al*. 1987)	84	124	158
Big Creek, Pend Oreille Drainage (Horner et *al*. 1987)	83	122	171
Upper West Branch River, Priest River Drainage (Horner et a/. 1987)	88	124	148
Dinarch Creek, Priest River Drainage, (Horner et *al. 1987)*	84	121	152
Skookum Creek (present study)	86	128	199
Cee Cee Ah Creek (present study)	92	134	195
LeClerc Creek (present study)	89	121	188
Tacoma Creek (pesent study)	80	122	198
Ruby Creek (present study)	88	147	- -

Table 4.5. Comparison of average back-calculated lengths at annulus for Pend Oreille River tributary cutthroat trout with other streams in the region.

	LENGTH AT ANNULUS FORMATION					
North Fork Flathead Tributaries (Fraley et al. 1981)	54	96	135	166	202	- -
Middle Fork Flathead Tributaries (Fraley *et al*. 1981)	51	95	139	193	251	- -
East River, Priest River Drainage (Horner *et al.* 1987)	95	136	171	- -	- -	- -
Big Creek, Priest River Drainage (Horner et al. 1987)	81	121	154	177	- -	- -
Kelly Creek, ID (Johnson and Bjornn 1978)	66	101	153	212	251	305
Upper St. Joe River, ID (Johnson and Bjornn 1978)	67	104	161	222	287	307
Salmon River, ID (Malet 1963)	57	95	165	241	305	352
Cee Cee Ah Creek (present study)	96	135	--	- -	- -	- -
Tacoma Creek (present study)	113	170	233	276	- -	- -
Ruby Creek (present study)	97	157	--	- -	- -	- -

4.3.2 RIVER AND SLOUGHS

4.3.2.1 LARGEMOUTH BASS

Largemouth bass in the Pend Oreille River were smaller at virtually every annulus than at other locations in the northern and northwestern United States (Table 4.6). Largemouth in the Pend Oreille fell behind other locations during the first 4 years of growth. Growth increments after the fourth year were comparable. The poor growth during the first four years was reflected in the condition factors (Table 3.41). The slow growth rates and decline in condition during the first 4 years indicates that food may be limiting bass growth until they reach a size that enables them to eat fish. The potential for competition was high given the large numbers of yellow perch and pumpkinseeds in the river. The mean condition factor for largemouth bass was comparable with those from other locations while the condition factors for bass 7 years and older was higher than bass from other locations (Table 4.6).

4.3.2.2 YELLOW PERCH

Pend Oreille River yellow perch lengths were lower than other locations at each annulus (Table 4.7). The slow growth rates in the Pend Oreille River were probably due to intense intraspecific competition due to the large population size. Condition factors for yellow perch in the Pend Oreille River were lower than for Deer Lake, WA and Lake Roosevelt, WA, but slightly better than in Loon Lake, WA (Table 4.7). High populations and significant intraspecific competition are factors known to contribute to the poor condition of Loon Lake yellow perch (Scholz et *al.* 1988).

4.3.2.3 MOUNTAIN WHITEFISH

Mountain whitefish growth rates were good in comparison with those of other areas (Table 4.8). The only locations found in the literature with higher growth rates were in the Kootenai River, MT, Okanogan Lake, B.C., and the Madison River, WY. Condition factors for mountain whitefish were seldom reported in the literature and those found were higher than those for the Pend Oreille River (Table 4.8).

Table 4.6. Comparison of average back-calculated lengths at **annulus** and mean annual condition factors for largemouth bass.

LENGTH AT ANNULUS FORMATION

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Potholes **Reservoir, WA** (Wydoski and Whitney 1979)	**71**	135	213	257	302	343	381	419	--	--	--	--	--	--
Sprague Lake, WA (Willms et a/. 1989)	103	137	192	247	292	326	**390**	--	--	__	--	--	--	--
Washington State (Min Ave.) (Wydoski and Whitney 1979)	68	89	152	170	163	216	241	356	356	432	--	--	--	--
Washington State (Max Ave.) (Wydoski and Whitney 1979)	74	229	267	343	411	457	457	483	--	508	--	--	--	--
Lake Washington (Wydoski and Whitney 1979)	107	213	290	343	376	429	450	485	--	--	--	--	--	--
N. Idaho (6 lakes) (Reiman 1963)	66	136	213	279	336	386	405	440	463	484	--	--	--	--
Montana lakes (Carlander 1977)	56	130	190	236	272	320	358	378	384	396	455	--	--	--
Oregon (96 waters) (Carlander 1977)	76	175	259	318	361	401	439	470	498	523	**531**	--	__	__
Wisconsin State Average (Carlander 1977)	64	166	267	318	356	384	**414**	442	460	475	495	505	513	523
Box Canyon Reservoir Pend Oreille River, WA (present study)	66	102	142	198	241	280	317	355	387	412	427	461	487	473

CONDITION FACTORS

Location	Age Class	Mean	Condition Factor	Range	Reference Cited
Michigan Average	--	K_{TL}	0.98	0.09-l **.01**	(Carlander 1977)
Wintergreen Lake, MI	--	K_{TL}	1.33	--	(Carlander 1977)
Pennsylvania Average	--	K_{TL}	- -	1.05-l **.55**	(Carlander 1977)
Sprague Lake, WA	I-VI	K_{TL}	1.57	--	(Willms et a/. 1989)
Loon Lake, WA	II-XIV	K_{TL}	1.41	--	**(Scholz** et *a/.* 1988)
Deer Lake, WA	III-IX	KTL	1.27	--	**(Scholz *et al.*** 1988)
Box Canyon Reservoir	I-XIV	K_{TL}	1.30	1 **.14-1 .82**	(present study)
Box Canyon Reservoir	VII-XIV	KTL	1.61	1.61-l **.82**	(present study)

Table 4.7. Comparison of average back-calculated lengths at annulus and mean annual condition factors for yellow perch.

	LENGTH AT ANNULUS FORMATION						
	1	2	3	4	5	6	7
Lake Roosevelt, WA (Beckman et *al.* 1985)	87	168	213	242	267	288	304
Lake Washington, WA (Wydoski and Whitney 1979)	98	173	227	262	284	301	312
Lake Michigan (Schaefer 1977)	97	137	178	204	230	251	262
Loon Lake, WA' (Scholz et a/. 1988)	--	--	111	165	199	198	228
Lake Mendota, WI (Wydoski and Whitney 1979)	140	197	227	239	--	--	--
Deer Lake, WA* (Scholz *et al.* 1988)	--	--	150	161	182	190	232
Box Canyon Reservoir Pend Oreille River, WA (Present study)	77	95	114	134	150	166	206

'Based on mean annual total lengths.

CONDITION FACTORS

Location	Age Class	Mean Condition Factor		Range	Reference Cited
Loon Lake, WA	II-VI	K_{TL}	0.98	0.91-l .01	(Scholz et al. 1988)
Deer Lake, WA	II-VII	K_{TL}	1.19	1.08-l .32	(Scholz *et a/.* 1988)
Lake Roosevelt, WA	I-V	K_{TL}	1.11	0.72-l .58	(Peone and Scholz.1988)
Box Canyon Reservoir Pend Oreille River, WA	I-VII	K_{TL}	1.04	0.97-l .12	(present study)

Table 4.8. Comparison of average back-calculated lengths at annulus and mean annual condition factors for mountain whitefish.

	LENGTH AT ANNULUS FORMATION							
	1	2	3	4	5	6	7	8
Montana Lakes (Carlander 1969)	91	190	241	272	300	325	356	- -
Montana Reservoir (Carlander 1969)	86	183	246	290	312	335	351	371
Montana Rivers (Carlander 1969)	86	180	246	292	328	353	368	419
Phelps Lake, MT (Carlander 1969)	160	193	229	251	269	290	307	318
Doctor Lake, MT (Carlander 1969)	46	84	119	157	193	226	254	282
Kootenai River, MT (May *et al.* 1983)	140	254	312	351	- -	- -	- -	- -
Wyoming Average (Carlander 1969)	99	206	262	290	318	338	- -	- -
Madison River, WY (Carlander 1969)	130	226	305	348	388	429	- -	- -
Logan River, UT (Carlander 1969)	117	206	259	295	325	358	391	417
Okanogan Lake, BC (Carlander 1969)	135	221	292	323	- -	- -	- -	- -
Box Canyon Reservoir Pend Oreille River, WA (present study)	174	219	259	299	360	390	413	435

CONDITION FACTORS

Location	Age Class	Mean Condition Factor		Range	Reference Cited
Logan River, UT	- -	K_{SL}	1.57	- -	(Carlander 1969)
Carter Creek, UT	- -	K_{SL}	1.50	- -	(Carlander 1969)
Box Canyon Reservoir	I-VII	K_{TL}	0.71	0.69-0.81	(present study)
Pend Oreille River, WA		K_{SL}	1.15	1.10-1.26	

4.3.2.4 BLACK CRAPPIE

Black crappie growth rates in the Pend Oreille River were about average as compared with other locations (Table 4.9). Condition factors were also about average (Table 4.9).

4.3.2.5 BROWN TROUT

Brown trout growth rates tended to be slightly lower in the Pend Oreille River than in other locations (Table 4.10), however, they did attain a respectable size. Several in excess of 600 mm were captured during this study. Condition factors for brown trout in the Pend Oreille River also tended to be slightly lower than at other locations (Table 4.10).

4.3.2.6 CUTTHROAT TROUT

Growth rates for cutthroat trout in the Pend Oreille River were about average in comparison to those from other locations (Table 4.11). Condition factors were lower than in other locations (Table 4.11).

4.3.2.7 BROOK TROUT

Growth rates for brook trout in the Pend Oreille River were slightly lower than those for other locations (Table 4.12). Condition factors in the Pend Oreille River for 2+ brook trout were lower than for other locations (Table 4.12).

4.3.2.8 RAINBOW TROUT

Pend Oreille River growth rates for rainbow trout were lower than those found in the literature (Table 4.13). Condition factors were also lower than those found in the literature (Table 4.13).

Growth rates for the last two to three cohorts have declined over previous years for most species in the Pend Oreille. One possible explanation of this trend is that the flows over the last several years have been well below normal. The last year that had a mean annual discharge that equaled or exceeded the 35 year mean annual flow was 1982. These lower flows may result in higher densities of fish in the reservoir while reducing the area of benthic macroinvertebrate production resulting in higher competition for food and space. Lower water levels may also result in higher water temperatures that increase the fish basal metabolic rates to such a

Table 4.9. Comparison of average back-calculated lengths at annulus and mean annual condition factors for black crappie.

	LENGTH AT ANNULUS FORMATION						
	1	2	3	4	5	6	7
Lake Washington, WA (Wydoski and Whitney 1979)	79	152	203	231	251	269	300
Lake St. Clair, WA (Wydoski and Whitney 1979)	--	--	236	249	269	--	--
Montana Lakes (Carlander 1977)	84	135	170	198	213	211	206
Montana Streams (Carlander 1977)	56	117	165	221	218	--	--
Three Forks Lake, MT (Carlander 1977)	28	61	94	122	145	168	178
Oregon (28 waters) (Carlander 1977)	53	135	183	211	231	224	--
Minnesota Waters (Carlander 1977)	61	122	173	211	241	267	295
Box Canyon Reservoir Pend Oreille River, WA (present study)	72	104	136	170	209	228	241

CONDITION FACTORS

Location	Age Class	Mean Condition factor		Range	Reference Cited
Chetek Lake, WI	--	K_{TL}	1.68	1.42-1.88	(Carlander 1977)
Minnesota Average	--	K_{TL}	--	1.22-1.50	(Carlander 1977)
Loon Lake, WA	--	K_{TL}	1.38	--	(Scholz *et al.* 1988)
Deer Lake, WA	--	K_{TL}	1.40	--	(Scholz *et al.* 1988)
Box Canyon Reservoir Pend Oreille River, WA	--	K_{TL}	1.39	1.34-1.68	(present study)

Table 4.10. Comparison of average back-calculated lengths at annulus and mean annual condition factors for brown trout.

	LENGTH AT ANNULUS FORMATION						
	1	2	3	4	5	6	7
Average U.S. streams (Wydoski and Whitney 1979)	96	203	282	348	444	495	551
Average U.S. lakes (Wydoski and Whitney 1979)	107	216	333	394	513	584	604
Loon Lake, WA' (Scholz *et* al. 1988)	- -	- -	205	290	419	539	- -
Spokane River, WA (Baily and Saltes 1982)	89	196	274	368	419	470	- -
Chamokane Creek, WA (Uehara et *al.* 1988)	120	194	283	342	410	- -	- -
Henry's Fork, ID (Brostrom and Spateholts 1985)	129	211	297	369	458	555	- -
Kootenai River, MT (May and Huston 1983)	104	216	295	365	- -	- -	- -
Missouri River, MT (Katherin 1951)	81	201	282	343	404	421	- -
Madison River, WY (Benson *et al.* 1959)	127	244	356	417	- -	- -	- -
Firehole River, WY (Benson *et al.* 1959)	135	234	328	398	- -	- -	- -
Box Canyon Reservoir Pend Oreille River, WA (present study)	98	167	249	341	411	468	507

*Based on mean annual total lengths.

CONDITION FACTORS

Location	Age Class	Mean Condition Factor		Range	Reference Cited
Montana Streams	I-V	K_{TL}	0.99	0.94-l .11	(Bishop 1955; Purkett 1951)
Missouri River, MT	II-V	K_{TL}	0.96	- -	(Kathrein 1951)
Chamokane Creek, WA	I-V	K_{TL}	1.05	0.97-l .11	(Uehara *et al.* 1988)
Loon Lake, WA	II-V	K_{TL}	1.01	- -	(Scholz *et al.* 1988)
Box Canyon Reservoir Pend Oreille River, WA	I-VII	K_{TL}	0.95	0.78-l .09	(present study)

Table 4.11. Comparison of average back-calculated lengths at annulus and mean annual condition factors for cutthroat trout.

	LENGTH AT ANNULUS FORMATION			
	1	2	3	4
Flathead Lake, MT (Leathe and Graham 1981)	57	109	173	247
North Fork Flathead River, MT (Fraley et *al.* 1981)	64	108	150	180
Thompson River, MT (Carlander 1969)	130	198	262	318
Priest Lake, ID (Wydoski and Whitney 1979)	81	135	211	300
Upper Priest Lake, ID (Carlander 1969)	94	142	216	292
Salmon River, ID (Carlander 1969)	107	150	213	279
Yellowstone Lake, WY (Wydoski and Whitney 1979)	46	130	224	312
Granby Reservoir, CO (Carlander 1969)	109	196	251	290
Box Canyon Reservoir Pend Oreille River, WA (present study)	102	176	239	287

CONDITION FACTORS

Location	Age Class	Mean Condition Factor		Range	Reference Cited
W. Gallatin River, MT	- -	K_{TL}	0.99	0.72-1.05	(Carlander 1969)
Pathfinder River, WY	- -	K_{TL}	1.06	0.97-1.19	(Carlander 1969)
Upper No Name Lake	- -	K_{TL}	1.05	- -	(Carlander 1969)
Salmon River, ID	- -	K_{FL}	1.30	- -	(Carlander 1969)
St. Joe River, ID	- -	K_{FL}	1.09	- -	(Carlander 1969)
Box Canyon Reservoir Pend Oreille River, WA	II-V	K_{TL} K_{FL}	0.91 1.10	0.89-1.05 1.03-1.21	(present study)

Table 4.12. Comparison of average back-calculated lengths at annulus and mean annual condition factors for brook trout.

	LENGTH AT ANNULUS FORMATION		
Montana lakes (Carlander 1969)	84	157	211
Montana streams (Carlander 1969)	76	135	205
Libby Lake, MT (Carlander 1969)	71	145	203
Hoodoo Creek, ID (Horner et *al.* 1988)	103	148	191
Granby Reservoir, CO (Carlander 1969)	117	173	196
Pigeon River, MI (Carlander 1969)	91	150	201
Box Canyon Reservior Pend Oreille River, WA (present study)	77	126	191

CONDITION FACTORS

Location	Age Class	Mean Condition Factor		Range	Reference Cited
Montana (7 mountain lakes)	- -	K_{TL}	0.98	0.75-l .40	(Carlander 1969)
W. Gallatin River, MT	- -	K_{TL}	1.10	1.00-l .28	(Carlander 1969)
Prickley Pear Creek, MT	I-III	K_{TL}	1.04	- -	(Carlander 1969)
Libby Lake, WY	o-v	K_{TL}	1.06	- -	(Carlander 1969)
Box Canyon Reservoir Pend Oreille River, WA	II	K_{TL}	0.90	- -	(present study)

Table 4.13. Comparison of average back-calculated lengths at annulus and mean annual condition factors for rainbow trout.

	LENGTH AT ANNULUS FORMATION				
Sprague Lake, WA' (Willms et al. 1989)	179	328	468	544	- -
Ross Lake, WA (Wydoski and Whitney 1979)	122	266	345	383	406
Pend Oreille Lake, ID (Pratt 1985)	78	170	334	460	510
Spokane River, ID (Bennett and Underwood 1987)	147	232	319	386	- -
Snake River, ID (Wydoski and Whitney 1979)	130	262	351	467	488
Montana Lakes 89 (Carlander 1969)	89	206	323	406	465
Kootanai River, MT (May and Huston 1983)	97	262	353	406	- -
Missouri River, MT (Carlander 1969)	81	201	282	343	404
Firehole River, WY (Carlander 1969)	135	234	328	396	- -
Madison River, WY (Carlander 1969)	127	244	356	417	- -
Box Canyon Reservoir Pend Oreille River, WA (present study)	105	154	233	321	387

*Based on mean annual total lengths

CONDITION FACTORS

Location	Age Class	Mean	Condition Factor	Range	Reference Cited
Sprague Lake, WA	I-III	K_{TL}	1.15	- -	(Willms *et al.* 1989)
Loon Lake, WA	I-V	K_{TL}	0.91	0.88-l .07	(Scholz et *al.* 1988)
Deer Lake, WA	I-V	K_{TL}	1.07	1.04-1.11	(Scholz et *al.* 1988)
Chamokane Creek, WA	I-V	K_{TL}	1.04	1.00-l. 10	(Uehara *et* al.1 988)
N. American Range	- -	K_{TL}	- -	1.00-l .35	(Carlander 1969)
Box Canyon Reservoir Pend Oreille River, WA	II,V	K_{TL}	0.90	0.86-l .03	(present study)

level that would require them to increase food consumption to maintain positive growth. Another possible explanation, for at least part of these differences, is that the individuals comprising the older cohorts represent the more fit, faster growing individuals with higher survival rates. Younger cohorts have not withstood several years of environmental stress to weed out the slower growing, less fit individuals that could result in lower mean back-calculated lengths.

4.4 FOOD AVAILABILITY IN THE RIVER, SLOUGHS, AND TRIBUTARIES

4.4.1 BENTHIC MACROINVERTEBRATE DENSITIES IN THE TRIBUTARIES AND INVERTEBRATE ABUNDANCE IN THE DRIFT

Table 4.14 compares the densities and diversities for the Pend Oreille River tributaries with the densities and diversities from streams of the same general size. Densities in the Pend Oreille River tributaries tended to be lower than other streams, however, the diversity values tended to be higher. These high diversity values show that even though densities were low, the streams were relatively healthy. Willm and Dorris (1968) used the Shannon-Weiner diversity values calculated from the benthic macroinvertebrate communities in riffles to categorize streams as polluted ($H < 3.0$) and non-polluted ($H > 3.0$). Drift densities and diversity values were not found in the literature so comparisons were not made.

4.4.2 BENTHIC MACROINVERTEBRATE DENSITIES IN THE RIVER AND SLOUGHS

The benthic macroinvertebrate densities in the Pend Oreille River were lower than in the Kootenai and Fisher Rivers in Montana, but, higher than those densities found in Lake Roosevelt, Washington and the Flathead River in Idaho (Table 4.15). Diversity was higher in the Pend Oreille River than in most of the locations found in the literature.

4.4.3 ZOOPLANKTON

Table 4.16 compares the densities of cladocerans and copepods found in lakes and reservoirs in the region with the mean number found in the Pend Oreille River. Pend Oreille River zooplankton

Table 4.14. Comparison of benthic macroinvertebrate densities and diversity indices from the Pend Oreille tributaries with other streams of similar stream order.

Location	Stream Order	Density $\#/m^2$	Diversity	Sampling Device	Reference Cited
Firehole River, WY	- -	940	- -	Hess	Armitage (1958)
Chamokane Creek, WA	3	53,569	3.27	Hess	O'Laughlin (1988)
Upper Blue Creek, WA	2	18,122	3.6	Hess	Cairns (1988)
Middle Blue Creek, WA	2	2,738	2.83	Hess	Cairns (1988)
Lower Blue Creek, WA	2	7,879	3.23	Hess	Cairns (1988)
Oyachen Creek, WA	1	5,010	3.1	Hess	Cairns (1988)
Mink Creek, ID (1968)	3	6,900	- -	Hess	Minshall (1981)
Mink Creek, ID (1969)	3	21,000	3.7	Hess	Minshall (1981)
Strawberry River, UT	- -	8,800	- -	Basket	Payne (1979)
Skookum Creek, WA	1	4,972	3.908	Hess	Present study
Cee Cee Ah Creek, WA	2	5,921	3.683	Hess	Present study
Tacoma Creek	3	4,907	3.476	Hess	Present study
LeClerc Creek	3	4,823	3.644	Hess	Present study

Table 4.15. Comparison of benthic macroinvertebrate densities and diversity indices from the Pend Oreille River with other reservoirs and rivers in the region.

Location	Density $\#/m^2$	Diversity	Sampling Device	Reference Cited
Kootenai River, MT				
Dunn Creek Station	28,112	1.64	Hess	Perry and Huston (1983)
Elkhorn Station	18,486	2.38	Hess	Perry and Huston (1983)
Pipe Creek Station	19,606	2.44	Kicknet	Perry and Huston (1983)
Fisher River, MT	10,676	3.6	Hess	Perry and Huston (1983)
Lake Roosevelt, WA				
Sanpoil Station	3,241	- -	Unknown	Beckman (1985)
Porcupine Bay Station	5,897	- -	Unknown	Beckman (1985)
Gifford Station	6,302	- -	Unknown	Beckman (1985)
Colville Station	9,352	- -	Unknown	Beckman (1985)
Flathead River	6,412	3.05	Kicknet	Perry and Graham (1982)
Libby Reservoir, MT				
Tenmile Area	639	- -	Peterson	Chisholm and Fraley (1985)
Rexford Area	1,074	- -	Peterson	Chisholm and Fraley (1985)
Pend Oreille River, WA	8,343	3.072	Ponar	Present study

densities are higher than most other locations including Lake Pend Oreille which is upstream of the present study location. The zooplankton densities in Coeur d'Alene Lake and River were higher.

Diaptomus ashlandi was frequently among the most abundant zooplankton species in the river. Reiman (1976) found this species to be common in Lake Pend Oreille and Hutchinson (1967) noted that it is characteristic of unproductive lakes.

There seems to be little relationship between mean monthly discharge (Fig. 2.1) and the total density of zooplankton (Fig. 3.1) or cladoceran biomass (Fig. 3.4). Rotifer densities appear to be positively correlated with discharge, however, copepod and cladoceran densities increase with decreasing discharges. Cladoceran biomass peaks in July, when discharges are low and biomass is low in April and June when discharges are high.

4.5 TRIBUTARY FISH FEEDING HABITS

All species demonstrated a great amount of variability in the composition of food items between individuals as demonstrated by the large standard deviations found in Appendix G.

Tables 4.17 through 4.20 show the Index of Relative Importance values for aquatic and terrestrial organisms for each species of salmonids found in the tributaries. Brown trout consumed a higher proportion of aquatic organisms than terrestrial organisms. The IRI for aquatic organisms was 66.7 in Skookum Creek, 86.2 in Cee Cee Ah Creek, and 80.9 in LeClerc Creek. The higher utilization of aquatic organisms by brown trout are comparable with the results of Cada *et al.* (1987).

Brook trout also consumed aquatic organisms more often than terrestrial organisms in each of the tributaries. The IRI for aquatic organisms was 66.9 in Skookum Creek, 89.6 in Cee Cee Ah Creek, 74.3 in Tacoma Creek, and 73.3 in LeClerc Creek. Griffith (1974) reported brook trout feeding only lightly on terrestrial organisms while consuming mainly aquatic organisms. The selection of aquatic organisms was correlated to their availability in the drift (Griffith 1974).

Cutthroat trout consumed a higher proportion of terrestrial organisms than any of the other species of fish found in the tributaries. The IRI for aquatic organisms was 36.4 in Skookum

Table 4.16. Comparison of zooplankton densities from the Pend Oreille River with other lakes and reservoirs in the region.

Location	Cladocera Mean #/l	Copopoda Mean #/l	Sampling Device	Reference Cited
Lake Roosevelt, WA	6.87	8.66	Clarke-Bumpus	Beckman *et al.* (1985)
Pend Oreille Lake, ID (1974)	8.8	18.45	Miller	Reiman (1976)
Pend Oreille Lake, ID (1975)	6.02	6.53	Miller	Reiman (1976)
Pend Oreille Lake, ID (1978)	1.71	13.96	Miller	Reiman and Bowler (1980)
Coeur d'Alene Lake, ID	10.76	56.36	Miller	Minter (1971)
Coeur d'Alene River Delta	10.46	46.03	Miller	Minter (1971)
Libby Reservoir, MT				
Tenmile Area	3.69	10.35	Wisconsin	Chisholm and Fraley (1985)
Rexford Area	3.6	8.96	Wisconsin	Chisholm and Fraley (1985)
Canada Area	4.23	4.05	Wisconsin	Chisholm and Fraley (1985)
Flathead Lake, MT	3.73	7.17	Wisconsin	Beattie *et al.* (1985)
Pend Oreille River, WA	8.4	27.0	Wisconsin	Present study

Table 4.17. Mean annual Index of Relative Importance (IRI) for aquatic and terrestrial prey items found in each age class of fish collected from Skookum Creek.

	Brown trout		Brook trout		Cutthroat trout	
Age class	Aquatic	Terrestrial	Aquatic	Terrestrial	Aquatic	Terrestrial
0+	65.8	34.4	69.1	31.1	64.6	35.2
1+	81.7	16.9	52.3	46.7	24.1	74.6
2+	68.0	32.4	76.3	23.1	20.6	79.5
3+	50.0	50.0				
Combined	66.7	33.6	66.9	32.5	36.4	63.2

Table 4.18. Mean annual Index of Relative Importance (IRI) for aquatic and terrestrial prey items found in each age class of fish collected from Cee Cee Ah Creek.

	Brown trout		Brook trout	
Age class	Aquatic	Terrestrial	Aquatic	Terrestrial
0+	92.3	8.6	81.2	19.3
1+	91.9	9.5	77.6	22.1
2+	74.4	26.6	100.0	0.0
3+	78.7	21.8	100.0	0.0
4+	84.1	16.1		
5+	100.0	0.0		
Combined	86.2	13.8	89.6	10.4

Table 4.19. Mean annual Index of Relative Importance (IRI) for aquatic and terrestrial prey items found in each age class of fish collected from Tacoma Creek.

	Brook trout		Cutthroat trout	
Age class	Aquatic	Terrestrial	Aquatic	Terrestrial
0+	88.8	11.1	98.6	0.0
1+	81.0	18.9	83.5	16.5
2+	53.3	46.8	29.1	69.9
Combined	74.3	25.5	70.5	28.7

Table 4.20. Mean annual Index of Relative Importance (IRI) for aquatic and terrestrial prey items found in each age class of fish collected from LeClerc Creek.

	Brown trout		Brook trout		Cutthroat trout	
Age class	Aquatic	Terrestrial	Aquatic	Terrestrial	Aquatic	Terrestrial
0+	76.0	24.1	77.5	22.4		
1+	90.7	7.3	69.6	31.6		
2+	91.9	8.1	71.8	27.2	24.7	75.1
3+	70.7	29.9				
4+	70.2	28.8				
Combined	80.9	19.8	73.3	27.0	24.7	75.1

Creek, 70.5 in Tacoma Creek, and 24.7 in LeClerc Creek. The older age classes of cutthroat trout consumed a larger proportion of terrestrial organisms. The tendency for larger cutthroat trout to feed on surface organisms was noted in a study by Shepard et a/. (1984).

An increased consumption of terrestrial invertebrates was observed in trout stomachs during the summer and fall sampling dates. The high consumption of terrestrial organisms during the late summer and autumn sampling dates may be an indication of the opportunistic consumption of drift items by trout. However, Hunt (1975) indicated that utilization of terrestrial organisms may relate, not only to varying input of terrestrials, but also to the productivity of a stream. Fish in streams with low benthic productivity may require consumption of large amounts of terrestrials to maintain growth in the warmer summer water temperatures.

For aquatic organisms, it was not possible to distinguish by diet analysis whether the fish were feeding from the benthos or the drift since it was not possible to determine if an organism was taken from the water column or the bottom. However, the importance of drifting organisms to the diet of trout is well known. A summary by Waters (1968) cited studies which have shown that trout feed heavier on those aquatic invertebrates that have higher drift tendencies. The groups of invertebrates that make up the greatest portion of the drift are Ephemeroptera, Simuliidae, Trichoptera, and Plecoptera (Waters 1972). These organisms are generally among the most common groups of organisms in the diets of trout in Pend Oreille River tributary.

The utilization of drift organisms versus benthic organisms utilized as food may be due to optimal foraging by trout or an indication of the systems productivity. Energetic costs of obtaining food may be a factor in determining what fish will feed upon. Fish **have been shown** to feed upon **invertebrates such that they** optimize energy intake (Ringler 1979). Benthic foraging requires the fish to expend energy in its search before the food item is captured leaving less energy for growth (Tippits and Moyle 1978). Benthic production is highest in riffle areas where the fish would have to expend energy to maintain its position (Waters 1972). Feeding from the drift, allows the fish to sit in **a pool** below a riffle and wait for prey to be carried to it, thus reducing the cost for acquiring food. Therefor, bottom feeding may not be as advantageous as feeding from the drift.

Electivities calculated using the abundance of prey items in the drift show that young brown trout have the highest electivities for Baetidae. Older brown trout had the highest selection for Limnephilidae. Brook trout and cutthroat trout were variable in their selection of prey from stream to stream.

Diet overlaps between tributary species were high only between brown trout and brook trout in Cee Cee Ah Creek. This is of little concern since these two species -are largely spatially segregated. Medium diet overlaps occurred between: brook trout and cutthroat trout in Skookum, and Tacoma Creeks; between brown trout and brook trout in LeClerc Creek; brown trout and mountain whitefish in LeClerc Creek; and brook trout and mountain whitefish in LeClerc Creek. The only overlap of concern is between brook trout and cutthroat trout in Skookum Creek since cutthroat trout are rare and may be outcompeted by the more abundant exotic.

Overlaps calculated between age classes of the same species were frequently medium to high between adjacent age classes. This should not be a problem as long as the trout population does not exceed the ability of the stream to produce food.

4.6 RIVER AND SLOUGH FISH FEEDING HABITS

River and slough fish, like the fish in the tributaries, had a large amount of variability in their feeding habits.

Yellow perch, black crappie, tench, and 0+ through 3+ largemouth bass were found to be primarily planktivorous. Mountain whitefish, pumpkinseed, brown trout, brown bullhead, longnose sucker, largescale sucker, peamouth, and northern squawfish primarily fed on benthic organisms. Cutthroat trout and redside shiner were found to contain mostly terrestrial organisms and 4+ and older largemouth bass and large northern squawfish fed on fish, usually yellow perch.

Due to the large yellow perch and pumpkinseed populations, the potential for interspecific and intraspecific competition for food was high. The diet overlaps for yellow perch and 0+ and 1+ largemouth bass was 0.735 and 0.844 respectively. Overlap values range from 0 to 1 with a value of 1 being complete overlap and values >0.7 considered high. Yellow perch had medium diet overlaps with 2+ bass (0.635) and 3+ bass (0.504). These overlaps are of concern since both species rely upon zooplankton (Daphnidae and Chydoridae), which were rare in the river, and Baetidae, which were rare in the benthic samples. Four year and older bass had very low overlaps with all species except northern squawfish (0.546). A similar situation of high overlaps exists between young bass and black crappie (0.69) and between black crappie and yellow perch (0.865).

Pumpkinseeds had high overlap indices with mountain whitefish (0.832) largely because they both utilized large numbers of Chironomidae larvae. Pumpkinseed also had a high overlap brown bullhead (0.868) and longnose sucker (0.675). Mountain whitefish also had a high overlap with brown bullhead (0.895). These overlaps are not of great concern since chironomids were relatively abundant in the benthic samples and these species of fish rarely occupy the same habitat. Food, along with habitat, is probably limiting trout production in the river since the construction of the Box Canyon Dam eliminated all the food producing riffle areas. Brown trout, in the river primarily selected Baetidae and Elmidae for food. These insect larvae both prefer faster moving water which is now uncommon in the Box Canyon Reservoir. Baetidae were rare in the benthics and Elmidae were moderately abundant.

4.7 FISH MOVEMENT AND MIGRATION

Tagged fish were found to be relatively stationary during this study. Two of the three brown trout, all of the mountain whitefish, one pumpkinseed, and one of the largemouth bass that had moved, simply moved from the river to an adjacent slough. Most of the fish that did move, moved only short distances, frequently less than one kilometer. One 250 mm cutthroat trout was exceptional in its journey of 80 km in 40 days. Two of the largemouth bass, three of the tench, and one of the largescale suckers that had moved were tagged during previous studies and were not considered as recaptures for the population estimate. Some of the bass movement may be attributed to bass anglers releasing bass in locations other than where they were caught, however the extent of this is impossible to determine.

4.8 CREEL SURVEY

Fishing pressure was extremely low from March through December, 1988 with only 4,139 estimated angler hours. A contributing factor for the low fishing pressure was the dam failure. Water levels in the sloughs dropped dramatically and many bass anglers did not fish the reservoir after the drawdown to allow the bass to spawn with a minimum of outside disturbance. Another factor that contributed to the low fishing pressure, to a much lesser degree, was the fishing closure imposed for six days in September because of the high fire danger in the region.

The CPUE for all fish caught was high at 2.9 fish/hour for boat anglers and 2.06 fish/hour for shore anglers. The high CPUE for boat anglers was primarily due to the success of bass anglers and the high CPUE for shore anglers was due to the large numbers of yellow perch in the littoral areas. The CPUE for fish harvested was 0.34 fish/hour due to the practice of catch and release fishing by most bass anglers. The main fish species harvested by boat anglers were yellow perch. The CPUE for fish harvested by shore anglers was 0.93 fish/hour, also consisting mostly of yellow perch.

Trout were rare in the creel making up 1.4 percent of the estimated total catch and 5.7 percent of the estimated harvest even though 28 percent of the shore anglers and 15 percent of the boat anglers indicated they were fishing for trout. Cutthroat trout was the most abundant trout species caught, making up 0.9 percent of the catch and 3.4 percent of the harvest. This information supports the conclusion that trout are rare in the reservoir as previously shown by the relative abundance data.

This was the first year of a three year study which is the first comprehensive fisheries investigation on the reservoir. Three questions came up during this first year of research. First, where in the reservoir do the large brown trout and mountain whitefish (>400 mm) that were caught in the late summer and fall at the mouths of some tributaries, spend the rest of the year? Juvenile brown trout were caught in the reservoir in low numbers throughout the year but the large adults were never seen. Mountain whitefish (<300 mm) were abundant throughout the reservoir in the spring and can be found in the more riverine sections during the rest of the year, however the larger mountain whitefish (>400 mm) were not caught in the reservoir.

The second question is where do the largemouth bass go once they leave the sloughs after spawning? Small numbers of adult largemouth bass were captured in the river during the non-spawning seasons, however, as with the larger brown trout and mountain whitefish, the sampling gear was not adequate for their capture. Sonic or radiotracking these fish may be the best way to determine their migration patterns and habitat use.

The third question is how much do the tributaries contribute to the reservoir fishery? Brown trout spawning was observed during November in Cee Cee Ah Creek and adult brown trout were captured at the mouths of several other tributaries so it is known that these fish do spawn in the tributaries. However, the number of trout recruited into the reservoir fishery and the age at which the trout move into the reservoir are unknown. The relative abundance data and scale data was not useful in determining at what age brown trout enter the reservoir because very few trout were captured. Trout that were captured showed no obvious change in the scale growth to indicate at what age they entered the river.

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